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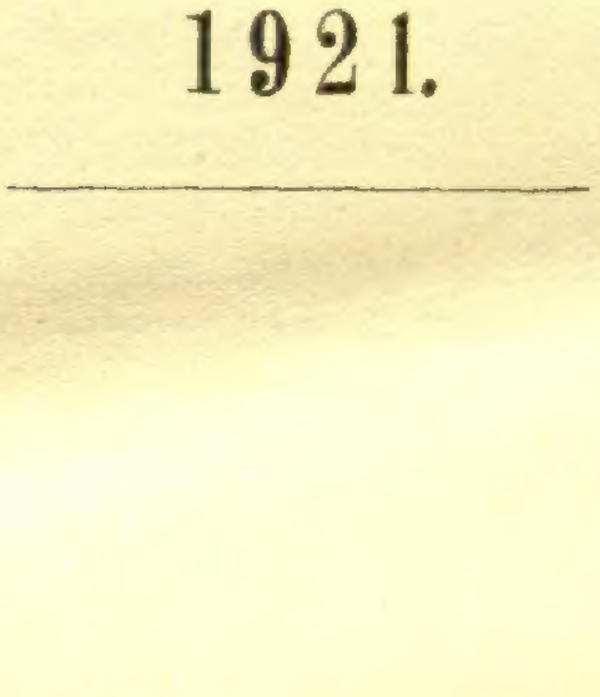
ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1921.



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ERRATA.

Page 30, line 20 from bottom, *for* A. E. Walters *read* E. A. Walters.
Page 126, last line, *for* Guinea *read* Guiana.
Page 129, line 3 of text, *for* cellulose *read* celluloid.
Page 240, line 17 from top, for *filicoides* read *filicoidea*.
Page 241, line 21 from top, *for* 241 *read* 245.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 1] [1921

I.—A REVISION OF THE AUSTRALIAN SPECIES OF STIPA.

D. K. Hughes.

A few months ago an inquiry concerning certain Australian species of *Stipa* of the *S. scabra* group was addressed to Kew. This necessitated, in the first place, comparison with the original of *S. scabra*, which was described very briefly by Lindley from a specimen collected by Mitchell (No. 125) on the Bogan River, New South Wales, and now in the Lindley Herbarium in Cambridge. Professor Seward was kind enough to send it to Kew so that a careful collation with the specimens referred by Bentham to *S. scabra* was possible. This resulted in the recognition of Mitchell's type as distinct from much of the material at Kew under that name. Very probably Bentham had never seen it, as he placed it in the group with "Ligules short, ciliate," whilst Mitchell's plant has quite conspicuous ligules over 3 mm. long. Nor do the specimens quoted by Bentham form a homogeneous group. The attempt to place the elements composing it into their proper species showed that most of the species which were drawn upon for comparison consisted of equally incongruous parts, so that nothing but a complete revision of the Australian species of *Stipa* could solve the problem. This Miss Hughes undertook under my supervision, with the result laid down in the present paper.

The admission of 40 species in the place of the 15 species of the Flora Australiensis may seem startling, the more so as only five species distinguished here are based on material unknown to Bentham. In some cases old species have been re-established, in others more recent collections brought out characters which were not so obvious in the older sets; but on the whole the explanation must be sought in the admittedly liberal conception of species characteristic of the author, a conception which in this, as in all pioneer work of that kind, may be looked upon as an almost unavoidable condition for

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completion within a practicable time. It is like the bold treatment of the first cast of a monumental work and, rightly and fairly understood, does not detract from the value of the work or the genius of the author. On the other hand, it challenges by its very nature the criticism of the specialist who is called upon to supply the more minute details with a view towards a final recognition of the taxonomic structure of the group. Neither the material available, nor the insight which we possess into the real value of the differences which present themselves in specimens mostly collected in a haphazard way, badly annotated, if at all, and frequently imperfect in some respects, warrants a claim to that finality having been reached. It is evident that nothing but painstaking and comprehensive analysis and the avoidance of unsupported generalisation can lead to the desired goal.

It is hoped that it is in this sense that the Australian botanists, working at the sources of our knowledge of those grasses, will receive this attempt at unravelling the threads of an unusually intricate taxonomic problem.

In explanation of the procedure adopted, I may add that the grouping of the species as it appears in the Key that precedes the Enumeration of the Species was obtained almost entirely from the comparison of external morphological characters such as a careful and catholic analysis revealed. Groups of wider and narrower extent presented themselves, and those which could not be further analysed without drifting away from apparently stable and therefore reliable characters were accepted as species. Some of the wider groups were obvious enough to be recognised at a glance, others less definitely circumscribed, suggested themselves in the first place through their more marked members which were found to form nuclei round which others clustered more or less evidently. Out of this combination of analysis and synthetic perception the Key grew almost automatically. The differentiation thus revealed of the whole plexus of forms under consideration rests, therefore, on a purely empirical basis such as might be expected to reflect natural relationships.

It was not until after the drafting of the Key was completed that I suggested that the result obtained should be tested by reference to the anatomical characters of the leaf-blades, partly to see how they compared with the grouping as it manifested itself through the external characters, and partly to gain additional data which might assist in the recognition of the species. The result of Miss Hughes' work in that direction is embodied in the text figures on pp. 19 and 29. The common experience that the variation of the anatomical structure of the leaf-blade of the grasses does not generally run parallel with the characters from which we infer their phylogenetic relationships, although they add frequently to the distinctiveness of the species, also holds good in the present case. Only one group (*Sclerophyllæ*)

stands out markedly from the rest, and even in that case the concept of the group rests largely on an external character (junciform leaf-blades), of which the anatomical character is but a paraphrase. Apart from this group, the anatomical structure of the leaf-blades varies on the whole within narrow limits, so that it will frequently be found useful as an ancillary character. To introduce these anatomical details into the Key, beyond the most marked instances, would have encumbered it unnecessarily without adding more than can be gleaned from the figures, which are at least as expressive as a description For the same reason I have advised Miss Hughes to desist from the incorporation of anatomical matter in her descriptions of new species.

The concurrent numbering of the species in the Key and Enumeration and of the figures will materially facilitate reference to the latter.

It was very tempting to extend the study to the problem of the relationship of the Australian *Stipæ* with their congeners in other parts of the world, the more so as the distribution of *Stipa* is very singular, but to do so would have entailed the revision of a larger amount of material and literature than was feasible. It may suffice to state in this place that there is no evident connection with the only undoubtedly indigenous South African species (*S. Dregeana*), and no striking relationship with the American species. On the other hand, the only two annual species are closely linked up with the Mediterranean *S. tortilis*.

O. Stapf.

Key to the Groups and Species.

The numbers of the species in the Key correspond to those of the Enumeration and of the figures. (The letters after the numbers on pp. 19 and 29 should read A instead of *a* in accordance with the quotations in the text.)

Valvule very small, rarely half as long as the valve, this glabrous or slightly hairy at the base, minutely scaberulous upwards; leaf-blades flat or involute without a continuous sclerenchymatic hypoderma, girders all percurrent or alternately percurrent and interrupted - - I. **Micropaleatae.**

Valvule as long as the valve or almost so; valve silky hairy mostly all along:

Hyaline margins of the valve produced at the tip into a small lobe on each side of the awn, lobes acute or acuminate, not less than 0·5 mm. long:

Leaf-blades reduced or quite rudimentary; stems hard and woody; spikelets 2·6 mm. long - - - II. **Aphyllae.**

Leaf-blades hard, junciform to subulate or setaceous, with a continuous sclerenchymatic hypoderma on both sides and strong percurrent girders, mesophyll much reduced; plants 60–90 cm. high; glumes 0·9–1·5 cm. long; valve mostly densely hairy, rarely glabrescent or puberulous upwards - - - III. **Sclerophyllae.**

Hyaline margins of the valve not produced into lobes, or, if so, then the lobes quite inconspicuous and obtuse, rarely more distinct (nos. 10 and 16), often only one developed; leaf-blades without a continuous sclerenchymatic hypoderma or only on the lower side, and then mostly very thin; girders alternately percurrent and dorsal or all percurrent :

*Perennial :

Bristle of the awn sharply recurved like a scythe or reaping hook; glumes delicate and hyaline at least towards the tips - - IV. **Falcatae.**

Bristle of the awn slightly curved or straight, often twice geniculate :

Awn plumose either in the upper or lower part; hairs up to 4 mm. long - V. **Plumosae.**

Awn apparently glabrous or pubescent, but not plumose :

Lateral nerves of lower glume continuing nearly the whole of its length and as prominent as the dorsal, giving the spikelets a striate appearance :

Glumes straight or upwards very gently incurved, not bulging below and arching over the floret, which is not or only slightly turgid - - VI. **Striatae.**

Glumes slightly recurved upwards bulging below and arching over the turgid floret, rather firm, 0·8–1·4 cm. long; awn twice geniculate up to 3·5 cm. long - - VII. **Turgidulae.**

Lateral nerves of lower glumes very faint or obsolete, usually present only at the base, therefore the glume not striate, delicate - VIII. **Aphanoneurae.**

Annual, or at least with no trace of a rhizome, sometimes with lateral tufts of leafy shoots at the base, the lowest sheaths of which are blade-bearing; glumes membranous, greenish, somewhat glistening - IX. **Annuae.

I. **Micropaleatae.**

Branches of the panicle long-plumose; spikelets 1–1·4 cm. long; leaves and sheaths finely scaberulous or quite smooth, rarely pubescent; girders percurrent - - - 1. *elegantissima.*

Branches of the panicle very shortly hairy; spikelets 9 mm. long; leaves densely pubescent; girders alternately percurrent and interrupted - - - - 2. *Tuckeri.*

II. **Aphyllae.**

Only species - - - - 3. *Muelleri.*

III. **Sclerophyllae.**

Valve densely hairy all over, lobes ciliate; leaf-blades stiff, junciform or subulate, quite smooth or almost so :

Hairs of valve whitish, about 2 mm. long; leaf-blades about 60 cm. long, very hard, quite smooth, oval in cross-section and tightly complicate :
Glumes about 0·9 cm. long, acute, usually yellowish brown; valve 0·7 cm. long - - 4. *juncifolia.*
Glumes 1·7–1·8 cm. long, acuminate, white, hyaline; valve 1·2 cm. long - - - 5. *teretifolia.*
Hairs of valve fulvous, not over 1 mm. long; leaf-blades usually much shorter than in the preceding species, loosely convolute and rather soft, smooth or very finely scaberulous; glumes 1·1–1·3 cm. long - - 6. *flavescens.*
Valve scantily hairy, glabrescent or scaberulous towards the tip, lobes glabrous; glumes 1·3–1·4 cm. long; blades setaceous, flexuous - 7. *oligostachya.*

IV. **Falcatae.**

Glumes 1·6–2 cm. long, finely scabrid all over :
Base of stem bulbous and woolly; leaf-blades scabrid, flexuose to cirrhiform, with a marked dorsal sclerenchymatic hypoderma; awn up to 10 cm. long - 8. *eriopus.*
Base of stem neither bulbous nor woolly; awn much shorter :
Leaf-blades smooth or scaberulous; awn up to 7 cm. long - 9. *tenuifolia.*
Leaf-blades very scabrid; awn 4·5–5 cm. long - - 10. *leptophylla.*
Glumes 0·7–1·4 cm. long, smooth; awns 4–9 cm. long :
*Ligule not over 1 mm. long, usually represented only by a ciliate rim :
Plants slender and delicate up to 45 cm. high, the basal sheaths very short, 1–3 (rarely 4) cm. long :
Glumes 1·1–1·4 cm. long, entire; leaf-blades scabrid or hairy :

Leaf-blades conspicuously and reversedly hairy; basal sheaths 2–3 cm. long, bright orange-coloured - 11. *trichophylla.*

Leaf-blades scabrid; basal sheaths 1–1·5 cm. long, pale - - - 12. *falcata.*

Glumes 0·7 cm. long, shallowly notched at the tip; leaf-blades scabrid - - 13. *arachnopus.*

Plants usually rather stout and well over 60 cm. high, the basal sheaths 4–6 cm. long:

Glumes 0·9–1·5 cm. long; valve hairy all along; awn about 6 cm. long; panicle up to 30 cm. long:

Leaves very hard and convolute, glabrous or finely scaberulous; panicle slender, the branches short, 3–6 flowered - - 14. *variabilis.*

Leaves softer than in *S. variabilis*, these as well as the sheaths shortly and densely pubescent all over; panicle dense, contracted, branches usually many flowered - - 15. *Drummondii.*

Glumes 1·5 cm. long; valve hairy below, scaberulous upwards; awn about 9 cm. long; panicle rarely over 15 cm. long - 16. *incurva.*

*Ligule elongated, 3–6 mm. long; blades and sheaths glabrous, sometimes slightly scabrid:

Awn about 8 cm. long, the column very slender, the bristle distinctly flattened; culms woody, about 90 cm. high - - - - 17. *platychaeta.*

Awn not over 6 cm. long, the column stouter than the bristle, which is not distinctly flattened; culms not more than 45 cm. high :
Culms compressible; blades and sheaths rather soft, slightly scabrid; awn up to 6 cm. long - - - - 18. *scabra*.
Culms wiry; leaf-blades hard, stiff, junciform, quite smooth and glabrous, awn not over 4 cm. long - - - 19. *pycnostachya*.

V. **Plumosae.**

Glumes about 1·5 cm. long; valve 0·6 cm. long; awn 3–4 cm. long :
Glumes pubescent; column of awn plumose on all sides, hairs up to 1 mm. long; bristle scaberulous - - - - 20. *densiflora*.
Glumes glabrous; column and bristle of awn unilaterally plumose, hairs up to 4 mm. long - - 21. *hemipogon*.
Glumes 1·7–2·4 cm. long; valve 0·8–1 cm. long; awn 7–9 cm. long :
Awn slender, column 1·4–3 cm. long, bristle 3–7 cm. long :
Awn white plumose along the column and base of the bristle, scaberulous towards the tip; hairs of the valve whitish :
Valve scantily hairy all along, the hairs not produced at the tip into a conspicuous tuft :
Column 1·4 cm. long; bristle up to 5·5 cm. long (from W. Australia) - - 22. *nobilis*.
Column 2 cm. long, bristle 6–7 cm. long (from S. and E. Australia) - - 23. *mollis*.
Valve densely covered with silky hairs, the uppermost produced into a tuft 2–3 mm. long - - 24. *stuposa*.

Awn greyish plumose all along, column about 3 cm. long, bristle 6 cm. long; hairs of valve fulvous - - - 25. *plumigera.*

Awn rather stout, column 3·5 cm. long, bristle about 4·5 cm. long - 26. *semibarbata.*

VI. **Striatae.**

Lower glume 2·1–3 cm. long, truncate or toothed; awn stout, whitish, 6–8·5 (rarely 11) cm. long; glumes glabrous or rarely pubescent - 27. *pubescens.*

Lower glume 0·8–1·7 cm. long, acuminate, entire; awn 3·5–6·5 cm. long, slender, usually turning dark in colour:

Inflorescence very lax; lower glume 1·4–1·7 cm. long; valve 0·9–1 cm. long, finally turning very dark brown with fulvous indumentum - - - 28. *rudis.*

Inflorescence dense, contracted, spikelike; glumes 1–1·4 cm. long; valve 7–9 mm. long, usually pale with white hairs (except *S. compacta*):

Sheaths densely bearded at the mouths with long white silky hairs; nodes glabrous; glumes tinged with dull violet - 29. *hirsuta.*

Sheaths shortly pubescent or glabrous at the mouths, but not bearded; nodes shortly and softly pubescent:

Glumes 1–1·2 cm. long; panicle up to 25 cm. long; awn 4·5–5·5 cm. long:

Glumes narrowly contracted; valve 0·8 cm. long, slender, with whitish indumentum 30. *tenuiglumis.*

Glumes not contracted; valve 0·9 cm. long, rather stout, with fulvous indumentum when mature - - 31. *compacta.*

Glumes about 1·4 cm. long; panicle up to 45 cm. long; awn 5·5 cm. long - - 32. *elatior.*

VII. **Turgidulae.**

Nerves of lower glume running out into three sharp teeth about 3 mm. long; glumes about 0·8 cm. long - 33. *aristiglumis.*

Glumes entire, 1–1·4 cm. long:

Glumes 1·2–1·4 cm. long, acutely acuminate; panicle very lax, internodes up to 6 cm. long - 34. *fusiformis.*

Glumes 1 cm. long, acute to subobtuse; panicle rather dense, internodes up to 3 cm. long - 35. *puberula.*

VIII. **Aphanoneurae.**

Ligule elongated, glabrous, up to 6 mm. long; awn 4 cm. long, twice geniculate; plant glabrous - 36. *setacea.*

Ligule short, ciliate:

Lower glume 1·5 cm. long; valve 0·8 cm. long; awn 5 cm. long; plant shortly pubescent - - 37. *aphanoneura.*

Lower glume 1·1 cm. long; valve 0·4 cm. long; awn 4 cm. long; plant glabrous or scaberulous - 38. *crinita.*

IX. **Annuae.**

Leaf-sheaths glabrous; basal leaves soft, convolute, 2 mm. wide when flattened out - - - - 39. *compressa.*

Leaf-sheaths, at least the lower, villous with short coarse whitish and brightly glistening hairs; basal leaves setaceously convolute, rather stiff - - - - 40. *lachnocolea.*

Enumeration.

The specimens to be accepted as "Types" are marked *.

1. **S. elegantissima,** *Labill.* Pl. Nov. Holl. i. 24, t. 29. (Figs. 1 & 1a, pp. 13 & 19.)

W. Australia. Shark's Bay, *Gaudichaud;* Murchison River, *Oldfield;* Swan River, *Drummond* 139, 222, 958; Kauring near Greenhills, *G. W. Brown* 532, 537; Lake Cowcowing, *Koch* 1133, p.p.; Dowerin-Merriden, *Stoward* 299; near Coolgardie, *Spencer Moore;* S.W. of Queen Victoria Spring, Elder Exploring Expedition, *Helms;* King George's Sound, *Baxter;* and without precise locality, *Ince; Collie;* Isle of Carnac, *Preiss* Herb. No. 1847.

S. Australia. Port Augusta, growing among bushes, *T. S. Lea;* Yayinga Mts., Victoria Expedition, Nov. 7th, 1860 (*coll. ?*); "Central Australia," *Capt. Sturt; Mitchell* 67.

New South Wales. Wyalong, *Boorman;* Murray River, *Dallachy;* Murrumbidgee, *F. Mueller.*

Tasmania. *Labillardière**.

2. **S. Tuckeri,** *F. Muell.* Fragm. Phytog. Austr. xi. 129. (Figs. 2 & 2a, pp. 13 & 19.)

New South Wales. Mt. Boppy, *Boorman;* Nipigan, *Boorman;* Lachlan and Darling-River, *Tucker** (not seen).

3. **S. Muelleri,** *Tate,* Trans. Roy. Soc. S. Austral. vii. (1885) 70. (Fig. 3, p. 13.)

S. Australia. Mount Lofty range, *Tate**.

4. **S. juncifolia,** *Hughes,* nov. sp. (Figs. 4 & 4a: pp. 13 & 19.) *Perennis,* caespitosa, ad 1 m. alta. *Culmi* erecti, teretes, glabri, laeves, 2–3 nodi, nodis glabris valde exsertis. *Foliorum* vaginae firmae, strictae, laeves, leviter striatae; ligulae elongatae, ovatae, ad 7 mm. longae, glabrae; laminae lineares, convolutae, rigidae, in acumen pungens longe attenuatae, usque 64 cm. longae, glabrae. *Panicula* glabra, e summa vagina exserta, anguste contracta, spiciformis, 16–20 cm. longa; rami pauci, inaequales, pseudoverticillati, laeves, 6–10 flori, ad 6 cm. longi; internodia 3–6 cm. longa, laevia; pedicelli 2–6 mm. longi, apice leviter discoidei. *Spiculae* fulvae, 9 mm. longae. *Glumae* subaequales, membranaceae, acutae, glabrae, inferior 3-nervis, superior sub-5-nervis. *Valva* cylindrica, 7 mm. longa, tota hirsuta pilis albis ad 2 mm. longis, 5-nervis, biloba, lobis acutis 1·2–2 mm. longis; callus 1·5 mm. longus, acutus; arista 5 cm. longa, columna robustiuscula 1 cm. longa; valvula valvam subaequans, truncata, dorso hirsuta. *S. flavescens,* Benth. Fl. Austral. vii. 566 p.p. non Labill.

W. Australia. Swan River, *Drummond* 4th Coll. 377*.

There is a great superficial similarity between this plant and *S. flavescens,* Labill., but the differences indicated in the key

appear to justify their being treated as distinct species. The specimens of both species in the Kew Herbarium are over-mature with practically all the florets shed.

5. **S. teretifolia,** *Steud.* Syn. Glum. i. 128. *Dichelachne stipoides*, Hook. f. Fl. N. Zeal. i. 294, t. 66; Fl. Tasman. ii. 112. (Figs. 5 & 5A, pp. 13 & 19.)

VICTORIA. Wilson's Promontory, *C. Stuart;* Point Lonsdale, *Tilden* 754.

TASMANIA. South Port, *C. Stuart;* George Town, *Gunn* 1490; Swanport, *Story* 18804.

" Forming tussocks growing in shingle at high water mark " (Gunn).

The species was originally described from a plant collected by D'Urville* at Western Port, Victoria. Although I have not seen it, there is no doubt as to its identity with the specimens quoted.

This plant is also found in New Zealand (*see* Cheeseman, Fl. N. Zeal. 857), growing abundantly in North Island in rocky or sandy places near the sea from the North Cape to the Bay of Plenty.

6. **S. flavescens,** *Labill.* Pl. Nov. Holl. i. 24, tab. 30. (Figs. 6 & 6A, pp. 13 & 19.)

TASMANIA. *Labillardière**.

7. **S. oligostachya,** *Hughes*, nov. sp. (Figs. 7 & 7A, pp. 13 & 19.) *Perennis*, caespitosa, ad 65 cm. alta. *Culmi* graciles, erecti, sublaeves, 2-nodi, ad nodos pubescentes, internodiis exsertis. *Foliorum* vaginae arctae, infimae hirsutae, summae glabrae, caeterae pubescentes vel glabrescentes; ligulae breves, dense ciliatae; laminae duriusculae, setaceo-convolutae, saepe recurvae, 12–20 cm. longae, glabrae vel leviter scabriusculae. *Panicula* laxa, pauciflora, valde exserta, 15–20 cm. longa; rami tenues, 2-5–flori, ad 7 cm. longi, minute scaberuli; pedicelli 0·6–1 cm. longi. *Spiculae* fulvae, ad 1·4 cm. longae. *Glumae* membranaceae, acutae vel acuminatae, glabrae; inferior 3-nervis, 1·4 cm. longa; superior 5-nervis, 1·2 cm. longa. *Valva* cylindrica, 9 mm. longa, luteo-hirsuta, superne scaberula, 5-nervis, biloba, lobis acutis 1·2 mm. longis glabris; callus 2 mm. longus, acutus; arista 5 cm. longa, columna bigeniculata subrobusta 2 cm. longa; valvula valvam aequans, dorso sparse pilosa.

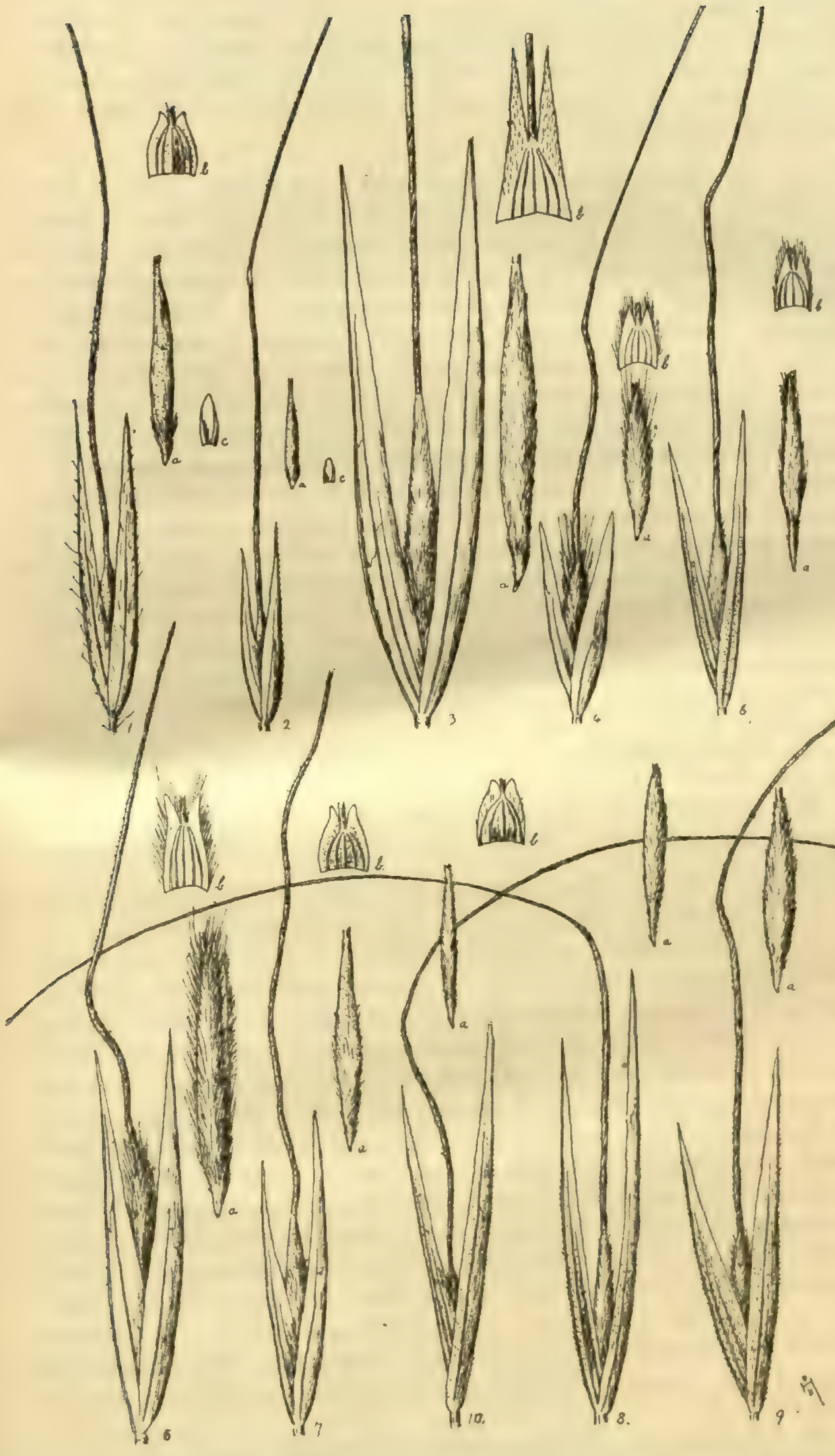
VICTORIA. Wendu Vale, growing in tussocks, *Robertson* 534*.

8. **S. eriopus,** *Benth.* Fl. Austral. vii. 570. (Figs. 8 & 8A, pp. 13 & 19.)

W. AUSTRALIA. Swan River, *Drummond* 962*.

9. **S. tenuifolia,** *Steud.* Syn. Glum. i. 128. *S. scabra*, var. *occidentalis*, Benth. Fl. Austral. vii. 571. (Figs. 9 & 9A, pp. 13 & 19.)

S.W. AUSTRALIA. Swan River, *Drummond* 220, 960, 963; and without precise locality, *Drummond* 391*.



Spikelets of species 1—10, × 3: *a*, valve; *b*, tip of valve·
c, valvule. × 3.

There is a specimen in the Kew Herbarium written up "N.W. Coast, N. Holld. Bynoe," in Sir W. Hooker's hand. To this was added "rather Drummond," in pencil by Bentham, who, however, does not quote the locality in the Flora Australiensis. The specimen is certainly *S. tenuifolia*, but its origin is entirely doubtful.

10. **S. leptophylla,** *Hughes*, nov. sp. (Figs. 10 & 10A, pp. 13 & 19.) *Perennis*, caespitosa, 70–90 cm. alta. *Culmi* erecti, teretes, 2-nodi, nodis glabris exsertis. *Foliorum* vaginae arctae, glabrae, laeves, striatae, inferiores cinnamomeo-rufae; ligulae breves vel unilateraliter elongatae, ad 2 mm. longae, ciliatae; laminae filiformes, setaceo-convolutae, usque 25 cm. longae, scabrae. *Panicula* anguste contracta, spiciformis, 20–35 cm. longa; internodia 3–6 cm. longa, laevia; rami pseudo-verticillati, inaequales, leviter scaberuli; pedicelli 2–7 mm. longi, glabri vel leviter scaberuli. *Spiculae* angustatae, vix hiantes, ad 1·8 cm. longae. *Glumae* inaequales, apice hyalinae, acuminatae; inferior 1·8 cm. longa, 3-nervis, dorso scabriuscula; superior 1·5 cm. longa, sub-5-nervis. *Valva* angusta, 6·5 mm. longa, ciliata, pilis albis, 5-nervis, biloba lobis subacutis 1–1·5 mm. longis; callus acutus, 1·2 mm. longus; arista 4·5–5 cm. longa, columna robustiuscula 1–1·1 cm. longa, seta subplana; valvula valvam aequans.

W. AUSTRALIA. Swan River, *Drummond* 381*.

11. **S. trichophylla,** *Benth*. Fl. Austral. vii. 570. (Figs. 11 & 11A, pp. 17 & 19.)

W. AUSTRALIA. Kauring on the York-Greenhills Line, *Stoward* 364, 458, 536; and without precise locality, *Drummond* 122*.

12. **S. falcata,** *Hughes*, nov. sp. (Figs. 12 & 12A, pp. 17 & 19.) *Perennis*, caespitosa, 30–45 cm. alta. *Culmi* erecti, 2-nodi, nodis glabris exsertis. *Foliorum* vaginae arctae, striatae, glabrae vel inferne subpubescentes, marginibus ciliatae; ligulae breves, dense ciliatae; laminae setaceo-convolutae, rigidulae, 4–8 cm. longae, scabrae. *Panicula* ad 25 cm. longa, 2–3 cm. lata; axis primarius subtriqueter, ut rami glaber; rami erecti vel sursum curvati, tenues, pauciflori, ad 5 cm. longi; pedicelli 0·2–1 cm. longi. *Spiculae* paulo hiantes, angustae. *Glumae* integrae, acuminatae, inaequales, delicatulae, basi violaceae, apice hyalinae; inferior 1·3 cm. longa, 3-nervis; superior 1·1 cm. longa, 5-nervis. *Valva* angusta, 6 mm. longa, parce albo-pilosa, 5-nervis, subintegra; callus acuminatus, 2·2 mm. longus, dense pilosus; arista 5·5–6 cm. longa, columna glabra vel minute scaberula 1·2 cm. longa, seta valde recurva; valvula valvam aequans. *S. setacea*, Benth. Fl. Austral. vii. 568 p.p. non R. Br.

W. AUSTRALIA. Blackwood River, *Oldfield* 675.
N.S. WALES. Murrumbidgee, *McArthur* 141*.
VICTORIA. Mount M'Ivor, *Blandowski*.

13. **S. arachnopus,** *Pilg.* in Diels and Pritz. Fragm. Phytog. Austral. Occ. 70, in Engl. Jahrb. xxxv. e descr. *S. setacea*, Benth. Fl. Austral. vii. 586 p.p. non R. Br. (Figs. 13 & 13A, pp. 17 & 19.)

W. AUSTRALIA. Swan River, *Drummond* 136 (or 961?); Coolgardie, near Bullabulling, *Diels* 5954* (not seen).

14. **S. variabilis,** *Hughes,* nov. sp. (Figs. 14 & 14A, pp. 17 & 19.) *Perennis*, caespitosa, 30–80 cm. alta. *Culmi* erecti, teretes, 1–2-nodi, nodis glabris vel subpubescentibus plerumque exsertis. *Foliorum* vaginae arctae, striatae, glabrae, glabrescentes vel raro pubescentes; ligulae saepe unilateraliter elongatae, ad 2 mm. longae, ciliatae; laminae lineares, convolutae, subflexuosae, in acumen longe attenuatae, 5–15 (raro 25) cm. longae, glabrae, leviter scaberulae vel pubescentes. *Panicula* 15–25 cm. longa, usque 2–3 cm. lata; axis primarius laevis; rami magis minusve erecti, tenues, pauciflori, ad 9 cm. longi, scaberuli; pedicelli saepe curvati vel nutantes, 3–8 mm. longi, scaberuli. *Spiculae* paulo hiantes, 1·2–1·5 cm. longae. *Glumae* subaequales, acuminatae, membranaceae, basi plerumque violaceae, apice hyalinae; inferior sub-3-nervis; superior 5-nervis. *Valva* cylindrica, 6–8 mm. longa, albopilosa, 5-nervis, apice integra vel subintegra; callus acuminatus ad 2 mm. longus; arista 6–7 cm. longa, columna scaberula vel pubescente 11–14 mm. longa, seta valde recurva; valvula valvam aequans. *S. setacea*, Hook. f. Fl. Tasman. ii. 110, t. 157; Benth. Fl. Austral. vii. 568 p.p. non R. Br.; *S. scabra*, l. c. 571 p.p. non Lindl.; *S. pubescens* var. *effusa*, Benth l. c. 570.

W. AUSTRALIA. Kauring on the York-Greenhills Line, *Stoward* 361, 459, 466 p.p.; Swan River, *Drummond* 961*; Ningham Country beyond the Arrowsmith River, *Monger*.

S. AUSTRALIA? "Central Australia," *Sturt* 16, 17.

VICTORIA. Wendu Vale in large patches, *Robertson* 531; Yarra River, *Mueller;* Port Phillip, *MacGillivray* 880; Murray River, *Mueller*.

TASMANIA. Without precise locality, *Gunn* 1487.

The specimens enumerated here comprise a variety of forms, but none of them seem specifically distinct. The glumes vary slightly in length, but all have the same texture and shape. *Robertson* 531, from Victoria, is the only plant with the lower leaf sheaths pubescent, but it agrees in all other particulars. The species seems very closely allied to *S. Drummondii*, Steud., which differs merely in the very much denser panicle with longer and more divided branches, the usually straighter awn and the texture of the blades. In *S. variabilis* the blades are mostly glabrous and exceedingly hard, showing in cross section very prominent nerves with thin weak tissue between them, causing them to split up readily. (Fig. 14A, p. 19.) In *S. Drummondii* the blades are densely pubescent, much softer to cut and only loosely or sometimes hardly convolute, and the tissue between the nerves is thicker with no tendency to splitting. (Fig. 15A, p. 19.)

Further, the column of the awn of this species is usually conspicuously white pubescent.

15. **S. Drummondii** *Steud.* Syn. Glum. i. 128. *S. scabra* var. *auriculata*, Black in Trans. Roy. Soc. S. Austral. xlii. 169 (1918). (Figs. 15 & 15A, pp. 17 & 19.)

W. AUSTRALIA. Swan River, *Drummond;* without precise locality, *Drummond*, 4th coll. 378*.

S. AUSTRALIA. Laura, Oct. 8th, 1916, *Black;* Moonta, Nov. 24th, 1919, *Black;* Pinnaroo, Oct. 12th, 1918, *Black;* Enfield, Nov. 10th 1919, *Black;* Adelaide, *T. S. Lea.*

N.S. WALES. Bogan River, collected in the open forest, *Mitchell* 24.

16. **S. incurva,** *Hughes*, nov. sp. (Figs. 16 & 16A, pp. 17 & 19.) *Perennis*, caespitosa, ad 65 cm. alta. *Culmi* erecti, teretes, 2-nodi, nodis glabris rarius exsertis. *Foliorum* vaginae firmae, scabrae vel glabrae, striatae, summae plerumque tumidae, paniculae basin amplectantes; ligulae brevissimae, ciliatae; laminae lineares, convolutae, in acumen pungens attenuatae, ad 20 cm. longae, valde scabrae vel rarius scabriusculae. *Panicula* 10–15, raro 20 cm. longa, usque 1 cm. lata; rami erecti, striati, leviter scaberuli, ad 8 cm. longi; pedicelli 0·5–2 cm. longi, saepe nutantes. *Spiculae* paulo hiantes. *Glumae* integrae, acuminatae, subaequales, usque 1·5 cm. longae, basi violaceae, apice hyalinae; inferior 3-nervis, dorso leviter scaberula; superior 5-nervis, dorso laevis. *Valva* cylindrica, cum callo 7·5 mm. longa, inferne pilosa, superne scaberula, 5-nervis, biloba, lobis minutis obtusis; callus acutus, 2 mm. longus, dense pilosus; arista 9 cm. longa, columna glabra vel sparse pubescens 2 cm. longa, seta valde recurva; valvula valvam aequans. *S. scabra* var. *pubescens*, Benth. Fl. Austral. vii. 571.

W. AUSTRALIA. Swan River, *Drummond* 138, 375*, 973; *Collie;* York District, Killerberrim, *Leake;* Harvey, *Stoward* 533, 766.

VICTORIA. Nidesdale, *Etheridge*, June, 1865.

17. **S. platychaeta,** *Hughes*, nov. sp. (Figs. 17 & 17A, pp. 17 & 19.) *Perennis*, haud caespitosa, ad 1 m. alta. *Culmi* erecti vel subgeniculati, teretes, lignosi, glabri, laeves, usque 10-nodi, iterum ramosi vel subfasciculati, internodiis exsertis; ligulae elongatae, ad 5 mm. longae, membranaceae, glabrae; laminae lineares, in acumen longe attenuatae, planae, ad 15 cm. longae, 2–5 mm. latae, utrinque glabrae. *Panicula* glabra, demum exserta, laxa, ad 20 cm. longa; internodia ad 4 cm. longa; rami primo erecti, maturi obliqui, 3–4-flori, ad 5 cm. longi; pedicelli 0·3–1 cm. longi, flexuosi. *Spiculae* parce hiantes. *Glumae* inaequales, delicatulae, basi violaceae, apice hyalinae, acuminatae; inferior 3-nervis, 1·2–1·5 cm. longa; superior 5-nervis, 0·9–1·2 cm. longa. *Valva* fusiformis, cum callo 5 mm. longa, integra, breviter pilosa; callus brevis, ad 0·6 mm. longus; arista usque 8 cm. longa, columna tenui 1 cm. longa, seta valde recurva manifeste compressa; valvula valvam aequans.

Spikelets of species 11—20, × 3: *a*, valve, × 3; *b*, tip of lower glume; *c*, tip of upper glume, × 6.

W. Australia. Lake Cowcowing, *Koch* 1133 p.p.*; 80 m. N. of Coolgardie, *Menzies*, 1st coll. 1207; and without precise locality, *Ince* p.p.

S. Australia. Upper Arkaringa Valley, *Helms*.

N.S. Wales. Murrumbidgee, *Mueller*.

18. **S. scabra,** *Lindl.* in Mitch. Trop. Austral. 31. *S. setacea*, Benth. Fl. Austral. vii. 568, non R. Br. (Figs. 18 & 18a, pp. 17 & 19.)

W. Australia. Fraser's Range, *Dempster*.

S. Australia. Elder Exploring Expedition (about 131·30° E. 27° S.), *Helms;* Mt. Lyndhurst, growing on elevated country, tablelands, &c., *Koch* 371; Gawler River, *Mueller;* and without precise locality, *Sinclair*.

Queensland. Warwick, *Beckler*.

N.S. Wales. Castlereagh, *Woolls;* Bogan River, *Mitchell* 125*.

19. **S. pycnostachya,** *Benth.* Fl. Austral. vii. 568. (Figs. 19 & 19a, pp. 17 & 19.)

W. Australia. Swan River, *Drummond;* and without precise locality, *Drummond* 121*.

20. **S. densiflora,** *Hughes*, nov. sp. (Fig. 20, p. 17.) *Basis* incognita. *Culmus* florifer robustus, nodis parce exsertis brevissime pubescentibus. *Foliorum* vaginae arctae, striatae, breviter et dense pubescentes, summae tumidae paniculae basin amplectantes ; ligulae brevissime sparse ciliatae; laminae laxe convolutae, in acumen attenuatae, superiores usque 13 cm. longae, utrinque breviter pubescentes. *Panicula* densissima, contracta, elliptico-oblonga, usque 20 cm. longa, 4 cm. lata; rami iterum divisi, multiflori. *Spiculae* angustae, subherbaceae. *Glumae* acuminatae, subaequales, usque 1·6 cm. longae, breviter pubescentes, 3-nerves. *Valva* 6 mm. longa, indistincte biloba, sparse albo-pilosa; callus acutus, 3 mm. longus; arista ad 3·8 cm. longa, columna 1·6–1·8 cm. longa breviter plumosa pilis albis ad 1 mm. longis, seta recta scabriuscula; valvula valvam aequans.

Central Victoria. Without precise locality, *Etheridge**.

21. **S. hemipogon,** *Benth.* Fl. Austral. vii. 569. *S. semibarbata*, var. F. v. Muell. Fragm. Phytog. Austral. viii. 104. (Figs. 21 & 21a, pp. 23 & 29.)

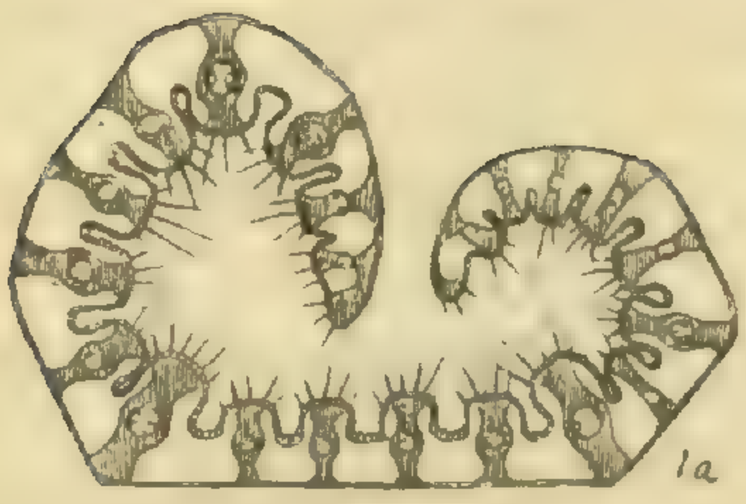
W. Australia. Swan River, *Drummond* 231, 376*; Lake Cowcowing, *Koch* 1132; Sikaltar District, *Spencer Moore*.

S. Australia. Garker's Range, *Mueller*.

22. **S. nobilis**, *Pilg.* in Diels and Pritz. Fragm. Phytog. Austral. Occ. 70 in Engl. Jahrb. xxxv. e descr. *S. semibarbata*, Benth. Fl. Austral. vii. 568, p.p. non R. Br. (Figs. 22 & 22a, pp. 23 & 29.)

W. Australia. Swan River, *Drummond* 116, 129; Kauring on the York-Greenhills Line, *Stoward* 474; Coolgardie, near Bronti, *Diels** (not seen).

23. **S. mollis,** *R. Br.* Prod. 174. *S. semibarbata*, Hook. f. Fl. Tasman. ii. 110 p.p. non R. Br.; Benth. Fl. Austral. vii.


1a

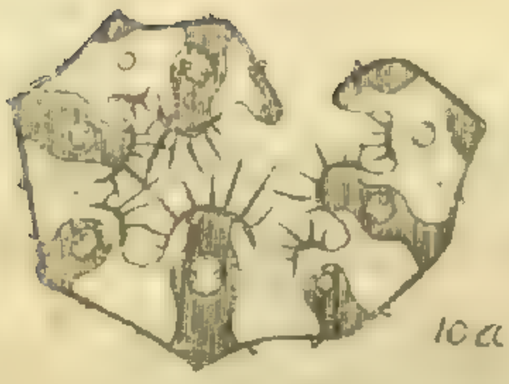
2a

4a

6a

5a

7a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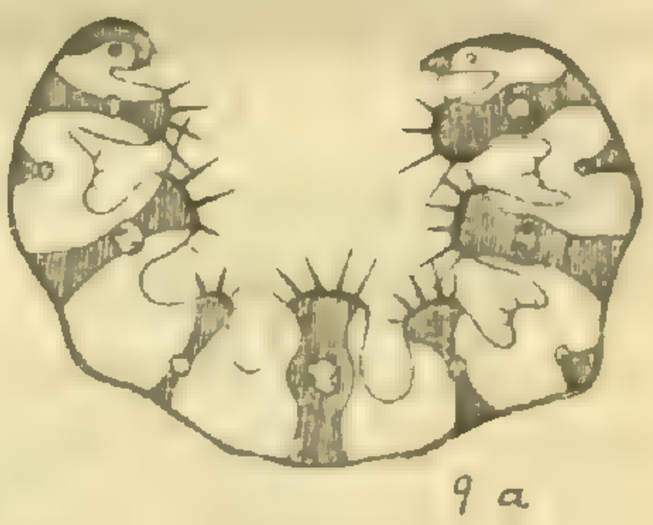
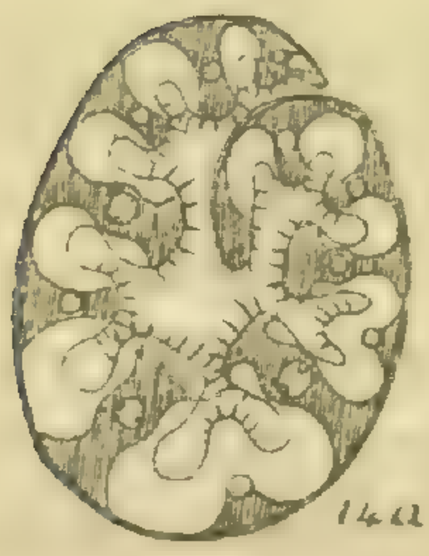
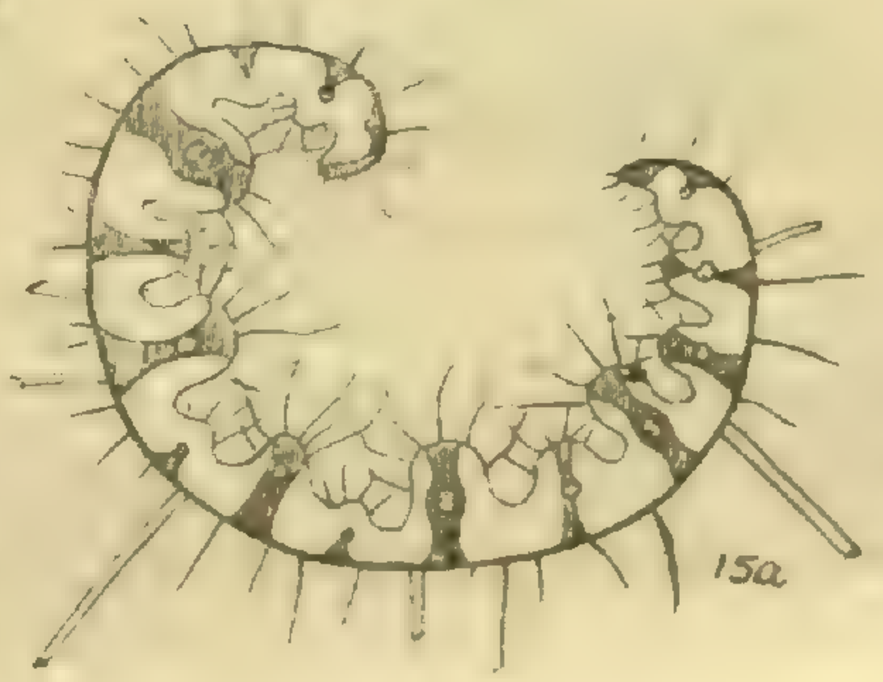

9a

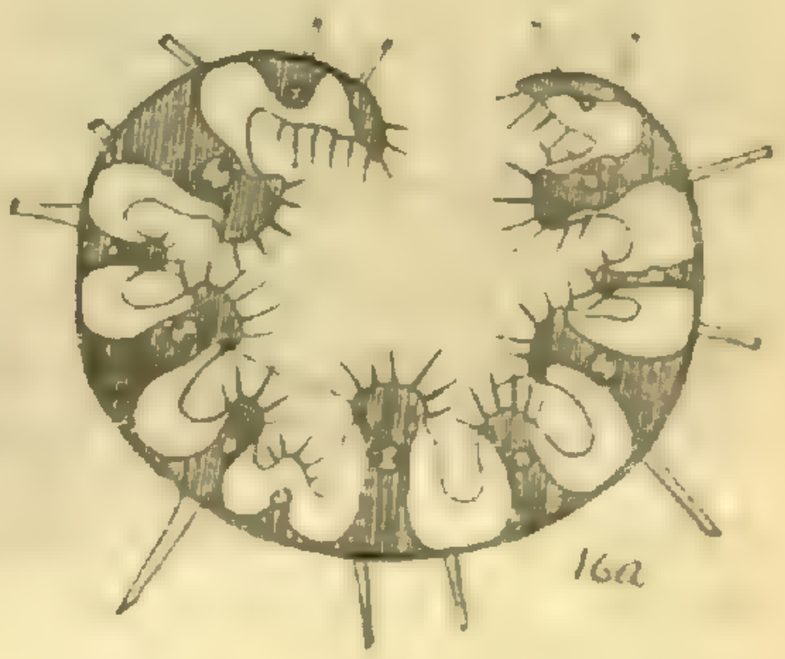
11a

12a

13a


14a


15a


16a

18a

17a

19a

Leaf sections of species 1—10, × 30.

569 p.p. non R. Br. *S. semibarbata*, var. *mollis*, Benth. l c. (Figs. 23 & 23A, pp. 23 & 29.)

N.S. WALES. Port Jackson, *Brown* 6205*; *Sieber*, *Agrostoth.* 60; *Kneucker* 196.

VICTORIA. Wendu Vale, forest land, *Robertson* 529; and without precise locality, *Harvey*.

TASMANIA. Port Dalrymple, *Paterson;* Hobart Town, *Gunn* 1452.

24. **S. stuposa,** *Hughes*, nov. sp. (Figs. 24 & 24A, pp. 23 & 29.) *Perennis*, vix caespitosa, ad 1 m. alta. *Culmi* erecti vel geniculati, teretes, 3-nodi, nodis exsertis molliter pubescentibus. *Foliorum* vaginae leviter striatae, praeter summas patule pubescentes, bases tandem in fibras longissimas tortas dissolutae; ligulae brevissimae, ciliatae; laminae lineares, convolutae, in acumen longe attenuatae, ad 20 cm. longae, patule pubescentes vel scabrae. *Panicula* angusta, contracta, ad 20 cm. longa; axis primarius teres, laevis; rami tenues, scabri, internodia vix excedentes, ad 10 cm. longi; pedicelli scabri, 2–8 mm. longi. *Spiculae* paulo hiantes, pallidae. *Glumae* inaequales vel subaequales, tenuiter acuminatae, membranaceae, apice longe hyalinae, dorso scaberulae; inferior 3-nervis, 1·7 cm. longa; superior 5-nervis, usque 1·5 cm. longa. *Valva* 1 cm. longa, integra, dense et manifeste hirta, pilis apice productis ad 3 mm. longis; callus acuminatus, 3 mm. longus; arista tenuis, non decidua, 5–6·5 cm. longa, columna breviter plumosa torta, 2·5 cm. longa; valvula valvam aequans.

TASMANIA. New Norfolk, *Gunn* 1480, Jan. 5th, 1840*; Port Arthur and Hobart Town, *Capt. Home*.

25. **S. plumigera,** *Hughes*, nov. sp. (Figs. 25 & 25A, pp. 23 & 29.) *Perennis*, caespitosa, usque 55 cm. alta. *Culmi* erecti, teretes, 2–3-nodi, nodis parce exsertis, molliter pubescentes. *Foliorum* vaginae arctae, leviter striatae, breviter pubescentes, marginibus oreque albo-ciliatae; ligulae non elongatae, dense ciliatae; laminae lineares, laxe vel vix convolutae, ad 35 cm longae, 2–3 mm. latae, supra breviter et dense pubescentes, infra glabrescentes. *Panicula* densa, contracta, usque 20 cm. longa; axis primarius teres, ut rami tenuiter scaberulus; pedicelli 1–5 mm. longi. *Spiculae* paulo hiantes, pallidae vel basi purpurascentes. *Glumae* inaequales, acuminatae, integrae, apice hyalinae; inferior 2 cm. longa, 3-nervis, dorso scaberula; superior 1·5 cm. longa, dorso laevis. *Valva* cylindrica, 8 mm. longa, hirsuta pilis fulvis; callus acuminatus, 3 mm. longus; arista gracillima, 9 cm. longa, columna et seta griseo-plumosis, pilis 1–1·5 mm. longis; valvula valvam aequans.

S. AUSTRALIA. Elder Exploring Expedition (about 130·80° E. 28° S.), *Helms**.

26. **S. semibarbata,** *R. Br.* Prod. 174. *S. semibarbata* var. *campylachne*, Benth. Fl. Austral. vii. 569 (Drummond specimen). (Figs. 26 & 26A, pp. 23 & 29.)

W. Australia. Swan River, *Drummond;* near Fremantle, among limestone hills, *Oldfield* 1004; "in arenosis silvae prope Pine-Apple, Perth," *Preiss* Herb. no. 1826; Leederville, *Stoward* 935; Gordon River, *Oldfield* 675; Bridgetown to Kojonup and Slab Hut Gulley, *Dorrien-Smith.*

S. Australia. Mt. Lofty Range, Belair, *Koch* 937; French Island, *Beveridge;* King George's Sound, *Collie.*

Tasmania. Penquite, *Gunn* 1480, Dec. 1845; Port Dalrymple, *Brown* 6204*.

S. campylachne, as described by Nees in Pl. Preiss. ii. 99, seems to be a plant with smaller spikelets (13–14 mm.) and shorter valves (6 mm.). I have not seen Preiss's specimen no. 1848 on which the species was primarily based, and am therefore doubtful as to its identity. Nees and Bentham (Fl. Austral. vii. 569) also quote a specimen of Drummond's from the Swan River under *S. campylachne* and *S. semibarbata* var. *campylachne,* respectively. The specimens of this variety as written up by Bentham himself are certainly identical with *S. semibarbata,* R. Br.

27. **S. pubescens,** *R. Br.* Prod. 174. *S. commutata,* Trin. and Rupr. Gram. Stip. 49. (Figs. 27 & 27a, pp. 23 & 29.)

Queensland. Brisbane River, *Cunningham.*

N.S. Wales. Port Jackson, *Brown* 6203*, *Sieber, Agrostoth.* 59; Blue Mountains, *Woolls* and *Calvert;* New England, *C. Stuart;* Sydney, *Stephenson* 261.

Tasmania. New Norfolk, *Gunn* 996 p.p.; Mount Direction, *Gunn;* Latrobe River, *Mueller;* Port Dalrymple, *Paterson;* and without precise locality, *Llotsky; Gunn* 588.

Gunn 588 and Mount Direction have somewhat more acuminate hyaline tips, but otherwise they agree well with *S. pubescens,* R. Br.

Under *Gunn* 996 there is a specimen dated 15.11.40, which agrees with another also by *Gunn* numbered 1453 and one by *Llotsky,* also from Tasmania, both having much stouter culms and broader leaf-blades than any of the specimens enumerated above. They are not *S. pubinodis,* Trin., and seem not to have been distinguished so far. They may represent a local race.

Variation occurs also in the length of the awns. In the type (*Brown* 6203) they measure 6–7·5 cm. long, while in one of *Llotsky's* specimens (without precise locality) they attain a length of 11 cm. This plant can hardly be called specifically distinct, as intergradations seem to exist between it and the type, so that I can only consider it as another example of a local variety or form.

28. **S. rudis,** *Spreng.* Syst. Cur. Post. 31. (Figs. 28 & 28a, pp. 23 & 29.) Descriptio emendata. *Perennis,* vix caespitosa, ad 1 m. alta. *Culmi* erecti vel geniculati, teretes, 2-nodi, nodis exsertis molliter pubescentibus. *Foliorum* vaginae leviter striatae, breviter pubescentes vel fere glabrae; ligulae brevissimae, glabrae vel minute ciliatae; laminae lineares, convolutae, in acumen longe attenuatae, ad 55 cm. longae, pubescentes vel glabrescentes.

Panicula angusta, contracta vel apertiuscula, ad 30 cm. longa; axis primarius teres, laevis; rami tenues, scabri, internodia vix excedentes, ad 9 cm. longi; pedicelli scabri, 2–8 mm. longi. *Spiculae* hiantes. *Glumae* subaequales, acuminatae, integrae vel subdentatae, apice hyalinae, ad 1·7 cm. longae; inferior 3-nervis; superior 5-nervis. *Valva* matura 1 cm. longa, integra, nigra vel fusca, sparse hirsuta pilis fulvis; callus acuminatus, 2 mm. longus; arista tenuis, matura nigrescens, 6·5–7 cm. longa columna breviter pubescente vel scaberula 2·5–3 cm. longa; valvula valvam aequans. *S. pubescens*, Benth. Fl. Austral. vii. 569 p.p., non R. Br.

W. Australia. Fremantle, among limestone hills, *Oldfield;* Leederville (near Perth), *Stoward* 586; Claremont, sandhills near the coast, *Cecil Andrews*, 1st coll., 1206; Swan River, *Collie*.

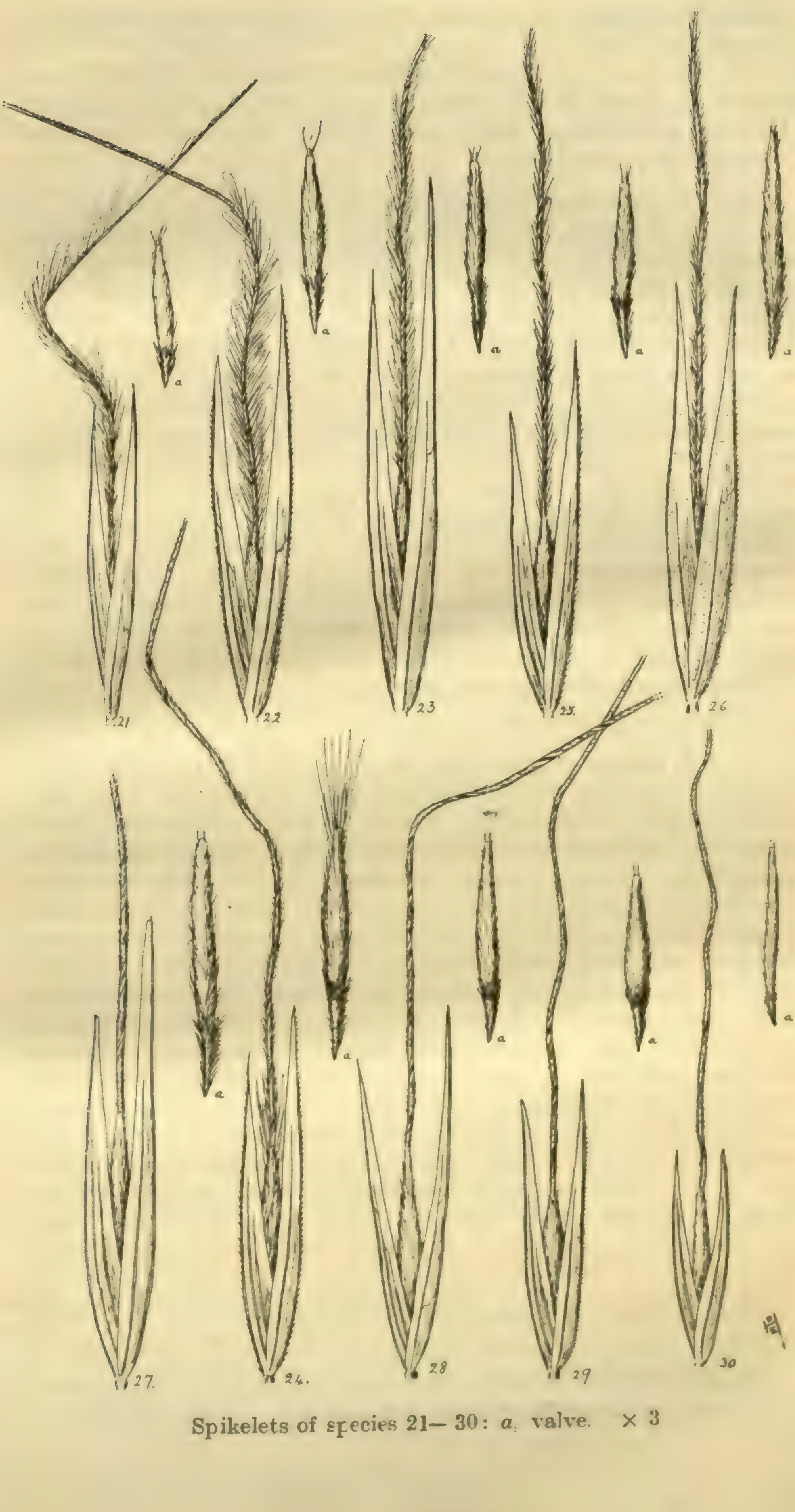
N.S. Wales. *Sieber* 66*.

Victoria. Wendu Vale, *Robertson* 533.

29. **S. hirsuta,** *Hughes*, nov. sp. (Figs. 29 & 29A, pp. 23 & 29.) *Perennis*, caespitosa, ad 60 cm. alta. *Culmi* erecti, teretes vel subcompressi, glabri, 2-nodi, nodis glabris exsertis. *Foliorum* vaginae arctae, striatae, sericeo-pilosae vel superiores glabrae, ore dense barbatae pilis albis ad 4 cm. longis; ligulae brevissimae, ciliatae; laminae lineares, convolutae, in acumen longe attenuatae, subflexuosae, ad 25 cm. longae, striatae, glabrae. *Panicula* angusta, contracta, spiciformis, ad 20 cm. longa; axis primarius teres, laevis; rami tenues, scabri, internodia vix excedentes, ad 10 cm. longi; pedicelli scabri, ad 4 mm. longi. *Spiculae* hiantes, purpurascentes. *Glumae* subaequales, acuminatae, integrae, apice hyalinae, usque ad 1·3 cm. longae; inferior 3-nervis, dorso scaberula; superior 5-nervis, nervis manifestis. *Valva* cylindrica, 8 mm. longa, luteo-brunnea, hirsuta pilis albis; callus acuminatus, ad 3 mm. longus; arista nigra, 5 cm. longa, columna breviter pubescente 1·7–2 cm. longa; valvula valvam aequans. *S. scabra*, Lindl. var. *barbata*, Benth. Fl. Austral. vii. 570.

W. Australia. Swan River, *Drummond**.

30. **S. tenuiglumis,** *Hughes*, nov. sp. (Figs. 30 & 30A, pp. 23 & 29.) *Perennis*, caespitosa, 50–60 cm. alta. *Culmi* erecti, teretes, glabri, laeves, 2-nodi, nodis glabris vix exsertis. *Foliorum* vaginae strictae vel apertiusculae, striatae, glabrae vel marginibus breviter ciliatae, summae interdum tumidae; ligulae brevissimae, sparse ciliatae; laminae lineares, convolutae, in acumen longe attenuatae, subflexuosae, ad 30 cm. longae, striatae, glabrae. *Panicula* densa, contracta, basi vaginata, 10–20 cm. longa, 1–3 cm. lata; axis primarius teres, laevis; rami filiformes, leviter scaberuli, ad 9 cm. longi; pedicelli 1–4 mm. longi. *Spiculae* hiantes, pallidae vel violaceae, striatae. *Glumae* exsiccatae tenues, acuminatae, integrae, subaequales, 1–1·2 cm. longae; inferior 3-nervis; superior 5-nervis. *Valva* pallide brunescens, tenuis, cum callo 8 mm. longa, sparse hirsuta pilis albis; callus acutus, 1 mm. longus; arista gracilis, 4·5 cm. longa, columna parce brevissima pilosula 2·5 cm. longa; valvula



Spikelets of species 21— 30: *a*, valve. × 3

valvam aequans. *S. scabra*, Lindl. var. *striata*, Benth. Fl. Austral. vii. 570.

W. Australia. Murchison River, Oolingarra, *Oldfield;* Sand near Woodman's Point, *Oldfield;* Swan River, *Drummond* 133*, 138 p.p.; Buckland Hill, near Perth, limestone hills, *Cecil Andrews*, 1st coll. 1205.

31. **S. compacta,** *Hughes*, nov. sp. (Figs. 31 & 31A, pp. 27 & 29.) *Perennis*, 60–80 cm. alta. *Culmi* erecti vel subgeniculati, teretes, laeves, usque 3-nodi, ad nodos pubescentes, caeterum glabri, internodiis inferioribus exceptis exsertis. *Foliorum* vaginae tandem laxiusculae, glabrae, leviter striatae; ligulae brevissimae, truncatae; laminae lineares, convolutae, in acumen longe attenuatae, 12–20 cm. longae (vel longiores [l]), glabrae. *Panicula* exserta, densa, contracta, spiciformis, 18–30 cm. longa, ad 2 cm. lata; rami internodia vix vel paulo excedentes, usque 7 cm. longi; pedicelli 2–6 mm. longi, ut rami ramulique leviter scaberuli. *Spiculae* ad 1·2 cm. longae. *Glumae* subaequales, subhyalinae, acuminatae, glabrae; inferior 3-nervis; superior 5-nervis, nervis conspicuis. *Valva* fusiformis, 9 mm. longa, luteo-pilosa, 5-nervis, biloba, lobis acutis 1 mm. longis; callus 2·5 mm. longus, acuminatus; arista 5–6 cm. longa, columna bigeniculata 2·5–3 cm. longa; valvula valvam subaequans, dorso pilosa. *S. flavescens* Hook. Fl. Tasman. ii. 110, Benth. Fl. Austral. vii. 566 p.p. non Labill.

Tasmania. *Gunn* 996 p.p.*

32. **S. elatior,** *Hughes*, nov. sp. (Figs. 32 & 32A, pp. 27 & 29. *Perennis*, robusta, probabiliter caespitosa, usque ad 1 m. alta. *Culmi* erecti vel geniculati, teretes, 4-nodi, pubescentes, nodis exsertis. *Foliorum* vaginae apertae, striatae, molliter pubescentes, marginibus oreque breviter ciliatae; ligulae non elongatae, brevissime ciliatae; laminae lineares, vix convolutae, in acumen longe attenuatae, subflexuosae, ad 70 cm. longae, 5–7 mm. latae, striatae, utrinque sparse hirsutae vel glabrescentes. *Panicula* anguste contracta, basi vaginata, ad 40 cm. longa, usque 2 cm. lata; axis primarius subteres, glaber; rami filiformes, scaberuli, ad 15 cm. longi; pedicelli scaberuli, 1–4 mm. longi. *Spiculae* hiantes, pallidae. *Glumae* acuminatae, integrae, subaequales vel inaequales, glabrae; inferior 1·4 cm. longa, 3-nervis; superior ad 1·35 cm. longa, 5-nervis, nervis manifestis. *Valva* pallide brunnescens, tenuis, cum callo 7·5 mm. longa, sparse hirsuta pilis albis; callus acutus, 1 mm. longus; arista gracilis, 5·5 cm. longa, columna parce brevissime pilosula 2·5 cm. longa; valvula valvam aequans. *S. scabra*, Lindl. var. *elatior*, Benth. Fl. Austral. vii. 570.

W. Australia, Swan River, *Drummond;* and no. 959*; Harvey, *Stoward* 775; King George's Sound, *Brown* 6203, p.p.

S. Australia, Adelaide, *T. S. Lea.*

Tasmania, Port Dalrymple, *Paterson.*

33. **S. aristiglumis,** *F. Muell.* in Trans. Vict. Inst. 1855, 43. (Figs. 33 & 33A, pp. 27 & 29.)

VICTORIA, Murray River, *Mueller**.

34. **S. fusiformis,** *Hughes*, nov. sp. (Figs. 34 & 34A, pp.27 & 29.) *Perennis*, caespitosa, 50–70 cm. alta. *Culmi* erecti vel geniculati, teretes, fere lignosi, glabri, 3-nodi, nodis pubescentibus vel glabrescentibus valde exsertis. *Foliorum* vaginae apertiusculae, striatae, glabrae; ligulae non elongatae, truncatae, fere glabrae; laminae lineares, laxe convolutae, in acumen longe attenuatae, usque ad 15 cm. longae, glabrae. *Panicula* laxa, pauciflora, usque 25 cm. longa; axis primarius gracilis, leviter scaberulus, subtriqueter; rami fasciculati, patentes, ad 8 cm. longi, scaberuli, 4–6-flori; pedicelli 1–2 mm. longi. *Spiculae* subherbaceae. *Glumae* valde acuminatae, valvam amplectantes, subaequales, 1·2–1·4 cm. longae, integrae; inferior 3-nervis; superior 5-nervis. *Valva* cylindrica, turgida, 8 mm. longa, 1–1·5 mm. lata, integra, breviter et dense sericeo-pubescens pilis luteis; callus acutus, 1 mm. longus; arista 3 cm. longa, seta recta; valvula valvam aequans. *S. aristiglumis* Benth. Fl. Austral. vii. 570 non F. Muell.

N.S. WALES, Cassilis, *Leichardt.*

VICTORIA. Avoca River, *Mueller;* Murray River, *Mueller* 19277*.

35. **S. puberula,** *Steud.* Syn. Glum. i. 128. *S. scabra*, Lindl. var. *occidentalis*, Benth. Fl. Austral. vii. 571. (Figs. 35 & 35A, pp. 27 & 29.)

S.W. AUSTRALIA (without precise locality). *Drummond*, 4th coll. 379*.

36. **S. setacea,** *R. Br.* Prod. 174. (Figs. 36 & 36A, pp. 27 & 29.)

QUEENSLAND. Warwick, *Beckler.*

N.S. WALES. Port Jackson, *R. Brown*, 6202 p.p.*; New England, *C. Stuart;* Edward's River, *Mueller;* Castlereagh, *Woolls.*

Cheeseman (Man., N. Zeal. Fl. 858) cites this plant as found in New Zealand, but in his opinion it is probably only naturalised there.

37. **S. aphanoneura,** *Hughes*, nov. sp. (Figs. 37 & 37A, pp. 27 & 29.) *Perennis*, caespitosa, 30–60 cm. alta. *Culmi* erecti vel geniculati, teretes vel subcompressi, pubescentes, 2–4-nodi, nodis dense pubescentibus plerumque exsertis. *Foliorum* vaginae strictae vel apertiusculae, striatae, cinereo-pubescentes; ligulae non elongatae, dense ciliatae, ciliae ad 2·5 mm. longae; laminae lineares, convolutae, in acumen longe attenuatae, 10–20 cm. longae, utrinque tenuiter et densiuscula pubescentes vel glabrescentes. *Panicula* contracta, usque 20 cm. longa, 2–3 cm. lata; axis primarius gracilis, vix scaberulus; rami fasciculati, leviter scaberuli, ad 6 cm. longi; pedicelli 1–3 mm. longi. *Spiculae* angustae, delicatulae, pallidae. *Glumae* inaequales vel subaequales,

acuminatae, membranaceae; inferior sub 3-nervis, nervis lateralibus fere obsoletis, 1·5 cm. longa; superior manifeste 5-nervis, 1·2–1·4 cm. longa. *Valva* cylindrica, 8 mm. longa, pilosula pilis albis, 5-nervis, integra; callus acutus, 2 mm. longus; arista 5–6 cm. longa, columna leviter torta parce brevissime pilosula usque 2 cm. longa, seta recta vel subcurva scaberula; valvula valvam aequans. *S. flavescens*, Benth. Fl. Austral, vii. 566 p.p. non Labill.

S. Australia. Swanport, *Story*.

Victoria. Murray River, *Dallachy*.

Tasmania. Kent's Group, *Brown* 6202 p.p.*

38. **S. crinita,** Gaud. in Freyc. Voy. Bot. 407. (Fig. 38, p. 27.)

W. Australia. Shark's Bay, *Gaudichaud**; and without precise locality, *Caley*.

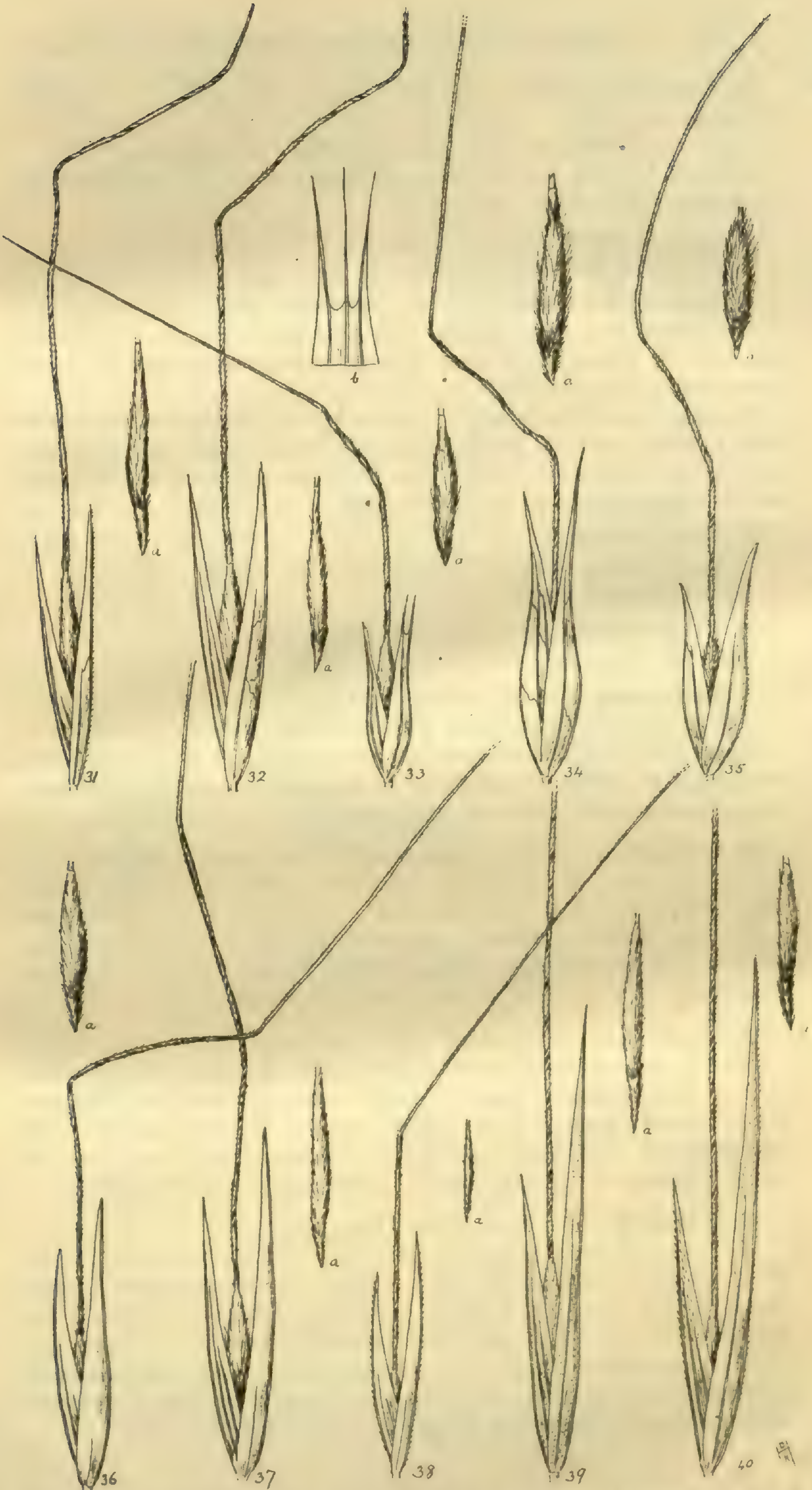
39. **S. compressa,** *R. Br.* Prod. 174. (Figs. 39 & 39a, pp. 27 & 29.)

W. Australia. Swan River, *Drummond*, and no. 134; Claremont, near Perth, in sand, *Cecil Andrews*, 1st coll. 1204; King George's Sound, *Menzies**, *Capt. King*; and without precise locality, *Collie*.

40. **S. lachnocolea,** *Hughes*, nov. sp. (Figs. 40 & 40a, pp. 27 & 29.) *Annua*, sed aliquando basi fasciculis foliorum omnium laminigerorum densis adjectis, 20–30 cm. alta. *Culmi* erecti, molliusculi, plerumque robusti, 1-nodi, nodis glabris non exsertis. *Foliorum* vaginae fasciculorum brevissimae, ad 1·5 cm. longae, pallidae, glabrae vel glabrescentes, culmorum inferiores herbaceae, ad 10 cm. longae, tomentosae pilis lucidis hyalinis, superiores striatae, glabrae, scaberulae, paniculae basin amplectantes; ligulae elongatae ad 1 cm. longae, glabrae; laminae fasciculorum setaceo-convolutae, usque 3 cm. longae, glabrae, foliorum culmorum laxe convolutae, in acumen attenuatae, 5–11 cm. longae, leviter scabriusculae. *Panicula* densa, contracta, ad 20 cm. longa, 1–2·5 cm. lata; axis primarius scaber vel scaberulus; rami fasciculati, scaberuli, ad 8 cm. longi; pedicelli 2–8 mm. longi. *Spiculae* nitidae, subhiantes, luteae. *Glumae* valde inaequales, membranaceae, acuminatae, ad apicem scaberulae; inferior 3-nervis, 2·2 cm. longa; superior 5-nervis, 1·4 cm. longa. *Valva* cylindrica, cum callo 7 mm. longa, breviter pubescens pilis luteis, subintegra; arista ad 12 cm. longa, columna valde torta usque 4·5 cm. longa praeter margines spirarum scaberulos laevi, seta subrecta tenuiter scaberula; valvula valvam aequans, dorso pubescens. *S. compressa*, var. *lachnocolea*, Benth. Fl. Austral. vii. 567.

W. Australia. Swan River, *Drummond* 132*; Kauring on the York-Greenhills Line, *Stoward* 466 p.p.

Victoria. Melbourne, common, *Adamson* 191.



Spikelets of species 31—40, × 3: *a*, valve × 2; *b*, tip of lower glume × 6.

Species Dubiae vel excludendae.

S. acrociliata, *Reader* in Vict. Nat. xiii. 167. *S. Readeri*, F. Muell. nomen.

Victoria. - Sandy desert, Lowanshire, 1895, *Reader*.

Placed by the author near *S. compressa*, *S. Drummondii*, *S. pycnostachya* and *S. setacea*.

S. campylachne, *Nees* in Lehm. Pl. Preiss, ii. 99.

See note under *S. semibarbata*, R. Br.

S. eremophila, *Reader* in Vict. Nat. xvii. 154.

To judge from the description this species must be closely allied to *S. oligostachya* and *S. leptophylla*, both having lobed valves and ciliate ligules.

It seems to differ from *S. oligostachya* in having longer glumes (1·4–1·8 cm. long), a shorter valve (0·7 cm. long), and a longer awn (8–10 cm. long), and from *S. leptophylla* in the reddish-brown indumentum of the valve and in the longer, stouter and twice geniculate awn.

S. laeviculmis, *Nees* in Lehm. Pl. Preiss, ii. 99.

Van Diemen's Land?

S. longearistata, *Steud.* Syn. Pl. Gram. 127.

"Urville legit ad Port George, N. Holl."

S. Luehmanii, *Reader* in Vict. Nat. xvi. 158.

Victoria. Sandy Desert, Lowan, 1898, *Reader*.

Placed by the author near *S. semibarbata* and *S. hemipogon*, from both of which it differs in having much smaller (7–8 mm. long) glumes, these truncate and toothed.

S. micrantha, *Cav.* Ic. v. 42, t. 467 (1799) non *R. Br.* q.v.

This species is probably identical with *S. ramossissima*, Trin. in Mem. Acad. Petersb., Ser. vi. (1831), i. 74, which has as its type *Sieber Agrostoth.* 82, with the valve very scabrid but not hairy and the awn about 1·6 cm. long. It is not a true *Stipa* but a *Dichelachne*, having 2 not 3 lodicules.

S. micrantha, *R. Br.* Prod. 175 (1810) non *Cav.*

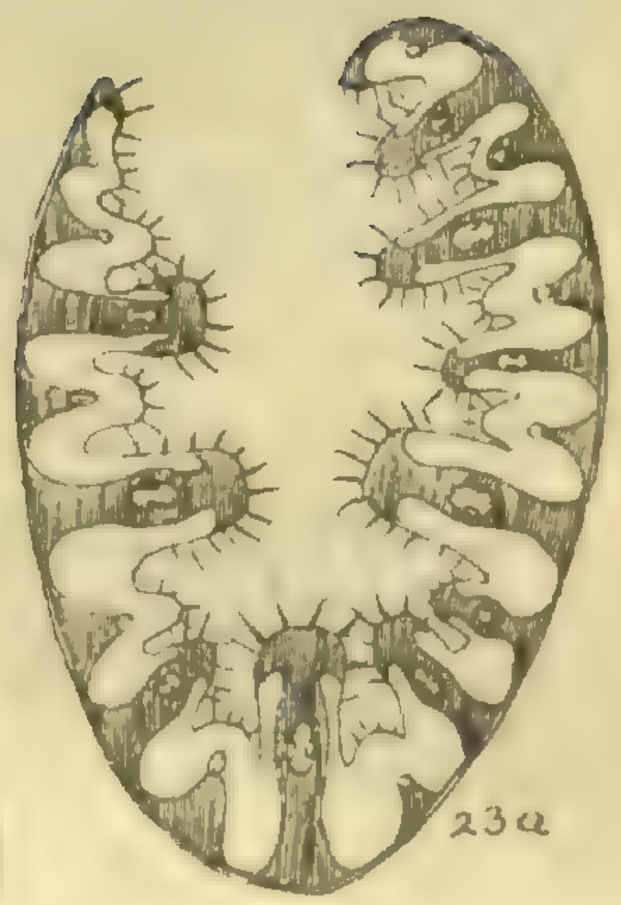
The type specimen (Brown 6201) differs from *S. micrantha*, Cav., in having the valve distinctly hairy all over and the awn about 4 cm. long. This plant agrees entirely with *Sieber Agrostoth.* 64, described by Nees in Spreng. Syst. Cur. Post, 30, under the name of *S. verticillata.* This also is a *Dichelachne.*

S. pubinodis, *Trin. and Rupr.* Gram. Stip. 50.

To judge from the description, this species must be closely allied to *S. pubescens*, R. Br. There are two specimens from Van Diemen's Land written up "S. pubinodis, Trin." by Munro. One is *Gunn* 588 and is identical with *S. pubescens*, R. Br., the other collected by *Llotsky*, is the stout form alluded to under *S. pubescens* and does not agree with the description of *S. pubinodis*, Trin. and Rupr.

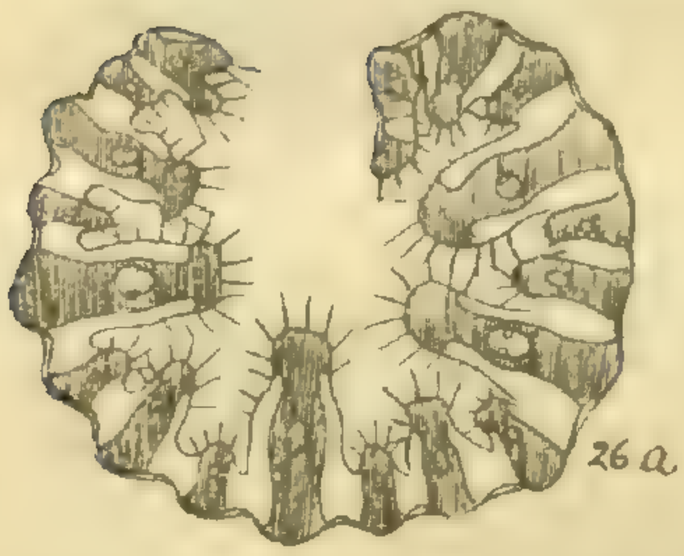
21a

22a


23a

25a

29a


26a

24a

28a

27a

31a

30a

33a

34a

32a

37a

35a.

36a.

40a

39a

Leaf sections of species 21—40, × 30.

S. setacea, var.? **latifolia,** *Benth.* Fl. Austral. vii. 568. *S. scelerata,* Behr. Herb. ex Benth. l.c.

S. AUSTRALIA. Augusta, *Behr*; Crystal Brook, *F. Mueller*; Murray River, *Blandowski.*

I have not seen any of the specimens quoted by Bentham, and from his brief description of this variety I am not able to judge their identity.

S. striata, *Link* Hort. Berol. 98.

AUSTRALIA ?

II.—MISCELLANEOUS NOTES.

We note with pleasure in the recently issued list of New Year Honours that His Majesty has been graciously pleased to appoint Dr. E. J. BUTLER, Director of the Imperial Bureau of Mycology, to be a Companion of the Most Eminent Order of the Indian Empire, and Dr. I. B. POLE EVANS, Chief, Division of Botany, Department of Agriculture of the Union of South Africa, to be a Companion of the Most Distinguished Order of St. Michael and St. George.

MR. E. W. DAVY, Agriculturist in the Agricultural Department of Nyasaland (K.B., 1905, 61), has been promoted by the Secretary of State for the Colonies, on the recommendation of Kew, to be Assistant Director of the Department.

MR. A. E. WALTERS, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, a Field Assistant, attached to the Laboratories of the Chemical Research Department, Kenya Colony.

MISS E. M. WAKEFIELD.—At the request of the Secretary of State for the Colonies, Miss Wakefield has been seconded for temporary service in the Imperial Department of Agriculture for the West Indies, to act as Mycologist to the Department. Miss Wakefield left Kew to take up her duties in Barbados in August, 1920. On the completion of her work in the West Indies, she will visit some of the pathological institutions in the United States of America, having been elected to a Travelling Scholarship by the Mary Ewart Trustees, before returning to Kew to resume her duties. During the first two months of Miss Wakefield's absence, Mr. Small, Mycologist in the Department of Agriculture, Uganda, has spent a considerable portion of his leave in carrying on the mycological work in the Herbarium, having been deputed to perform this service by the Secretary of State for the Colonies.

Captain A. W. Hill.—The Assistant Director has, with the concurrence of the Ministry of Agriculture and Fisheries, been deputed by the Secretary of State for the Colonies to visit and report on the Botanic Gardens, Victoria, Cameroons, and also to visit Nigeria. He sailed on January 19th, and is expected to be absent some three months.

William Harris.—We record with deep regret the death of Mr. W. Harris, F.L.S., which occurred in Kansas City, U.S.A., on October 11th, 1920. Mr. Harris entered the Royal Botanic Gardens, Kew, in June, 1879, and was appointed Superintendent of the King's House Garden, Jamaica, on August 29th, 1881. Mr. W. Fawcett, who was for many years Director of Public Gardens and Plantations, Jamaica, has kindly furnished us with the following account of Mr. Harris's work in Jamaica.

"When I succeeded Sir Daniel Morris as Director in 1887, Harris was in charge of Castleton Garden, the chief Botanic Garden. On my first visit to this garden, I was struck with its excellent condition and the order and neatness that prevailed. This was the dominant feature in all Harris's work. Besides the King's House and Castleton Gardens, there are others in charge of the Department—all of which were for a time under Harris's superintendence—the Hill Garden, situated at an elevation of 5,000 ft., adjacent to the Government Cinchona Plantations, the Parade Garden or Victoria Park, situated in Kingston, and the old Botanic Garden at Bath, 44 miles from Kingston, which is still kept up for the sake of the magnificent old trees, palms, and other plants, some of them planted by Dr. Clarke in 1779 and subsequent years, others by Dr. Dancer in 1788 to 1798, and others by the Kew gardener, Nathaniel Wilson, from 1846 to 1860. Besides these gardens the Government kept up a trial plantation of numerous varieties of sugar cane on an old sugar estate called Hope, about 5 miles from Kingston. Harris was moved from Castleton to Hope in 1887 to commence the formation of a new botanic garden. In 10 years it had developed into a large garden with 6 acres of lawns, $3\frac{1}{2}$ acres of ornamental borders, also ferneries and glasshouses for delicate plants; collections of orchids, roses, crotons and palms; plantations covering $7\frac{1}{2}$ acres of the chief economic plants as well as 6 or 7 acres of teak. Harris was for the first four years engaged in the laying out of this garden. Then followed nine years of work in the Hill Garden. It was then that it was possible to send him out on collecting tours in search of specimens for the Herbarium. He had shown a capacity for such work, and it was a great pleasure to be able to satisfy his enthusiasm and at the same time to benefit the Herbarium. He became an excellent field botanist with great and accurate knowledge of the local flora. He described one of his tours in a communication to the 'Gardeners' Chronicle' (3rd ser. xix. 1896, pp. 134, 197,

263). Some two years ago he had bought a house in a central situation, hoping in a few years to retire and give up his whole time to exploration and collecting. His good work in connection with the flora has been honoured by the number of plants which bear his name, and also by the two new genera *Harrisia* in *Cactaceae* and *Harrisella* in *Orchidaceae*. His death is an irreparable loss to botanical exploration in Jamaica. He did all his work very methodically and thoroughly, and was always a most helpful and loyal assistant to me. Personally, I mourn the loss of a good and well-tried friend. In 1908, on my retirement and the formation of a Department of Agriculture, which included the Department of Gardens, Harris was made Superintendent of Public Gardens with charge of all the Gardens. In 1917 his good work was recognised by the Government by giving him the title of Government Botanist, and in 1920 he was promoted to be Assistant Director. He was elected a Fellow of the Linnean Society in 1899."

David Ernest Hutchins.—The news has just reached us from New Zealand of the death of a distinguished forester, Sir David Ernest Hutchins. In his long period of public service he has become well known in many parts of the Empire, no less for his alert figure and genial hearty manner than for the skill and never-failing energy with which he has handled the various forestry problems with which he has been called upon to deal.

Born in 1850 he began his forestry training when 20 years old at the Ecole Nationale des Eaux et Forêts, Nancy, in company with such afterwards famous foresters as Mr. E. P. Dansey, Mr. Harry C. Hill and Mr. W. R. Fisher. He was then appointed Deputy Conservator in Mysore, and at once showed his wide views of forestry in two papers which he wrote on Australian trees in the Nilgiris and on the coastal planting of *Casuarina*. These papers are still standard works on their subjects. In 1882 he was transferred to Cape Colony, where, after some years passed in charge of the Knysna forests, he succeeded Count Vasselot de Regné as Chief Conservator and remained until 1905. The numerous large plantations of Australian Eucalypts in all parts of South Africa will be a never-dying memorial there to his enterprise. After leaving the Cape he was called upon to organise the Forestry Department in British East Africa, and while there succeeded in demarcating reserves and, among other things in establishing economic plantations of the Chinese Coffin-wood tree (*Persea nanmu*).

When he retired and came home, his extraordinary talent for organising forestry work was not long left idle.

In 1907 he was employed by the Colonial Office to report on the value of the Kenia forests (Col. Rep. Misc. 41, 1907), and in 1909 to inspect the forests of Cyprus (Rep. on Cyprus Forestry, 1909). In 1914 he had a long-looked-for opportunity of visiting

Australia and of seeing in their native habitats the trees he had so often planted. In 1916 the Western Australian Government published his work on Australian Forestry. He next visited New Zealand for the purpose of advising the Government on the preservation of the valuable Kauri trees (Waipoua Kauri Forest, its demarcation and management, 1918). In 1920, in recognition of the above services, the honour of knighthood was conferred upon him, thus fittingly closing his long and distinguished career.

Henry F. C. Sander.—The death of Mr. H. F. C. Sander, F.L.S., which occurred at Bruges on December 23rd, 1920, in his 74th year, deprives commercial horticulture of one of its most active leaders. For many years Messrs. Sander and Sons, Nurserymen, St. Albans and Bruges, were the principal importers of orchids and other tropical and subtropical plants, to the great advancement of indoor gardening. He was a liberal contributor to Kew, the orchid collection being largely indebted to him for many new and rare species, as also are the collections of stove plants, including palms, ferns, cycads, &c. He also presented many dried specimens obtained by his collectors in tropical countries. The largest example of *Grammatophyllum speciosum* (*Bot. Mag. t.* 5157) ever seen in Europe, which has for many years been a striking object in the Victoria House, where it has flowered several times, was presented to Kew by Mr. Sander in 1893, having been obtained at considerable expense from the forests of Penang. Mr. Sander did much to foster a love for orchid cultivation in this country by his enterprise in collecting and importing the most attractive species in quantity. He was also one of the first to realise that home-raised orchids, particularly hybrids, were worthy of attention, and many of the most popular hybrids were bred in his nurseries. He grew for exportation enormous numbers of palms, azaleas, camellias, bays, tuberous begonias, &c., employing hundreds of men in his two nurseries, which comprised over 4 acres of glasshouses in St. Albans and over 100 in Bruges, many of them of great dimensions. At one time there were 30 houses devoted entirely to orchids in the Bruges Nursery. Mr. Sander combined with great business capacity a keen love of plants of all kinds, and an extraordinary skill in arriving at the best cultural treatment for new and untried plants. His exhibits of orchids and other plants at the great shows held in London, Paris, St. Petersburg, Vienna and other centres were much appreciated by connoisseurs. Botany as well as horticulture owes much to his zeal and enterprise. W. W.

Earlier Hours of Opening.—The Minister of Agriculture and Fisheries has had under consideration the question of the hours of opening to the public of the Royal Botanic Gardens, Kew,

Hitherto admission to the Gardens on week days has been from 10 a.m. during the summer months and from noon during the winter months. Admission on Sundays has been from 1 p.m. throughout the year. Lord Lee of Fareham has now issued instructions that the public be admitted every day, except Christmas Day, throughout the year from 10 a.m., with effect from 1st January, 1921.

The number of visitors to the Gardens during 1920 was 1,131,771.

Additions to Gardens, 1920.—The number of separate consignments of living plants, seeds, &c., to the Gardens was 390. The most important were the following :—

Glasnevin Botanic Gardens.—Various trees, shrubs and seeds; *Briggsia amabilis*, *Lilium Bakerianum*, and 8 species of Cistus.

Edinburgh Botanic Garden.—Various plants and seeds; *Ouvirandra fenestralis.*

Cambridge Botanic Garden.—Various stove and greenhouse plants.

R.H.S. Gardens, Wisley.—30 species of herbaceous plants; 17 packets of seeds collected by Forrest.

John Innes Horticultural Institution, Merton.—Various plants and seeds.

Wellcome Chemical Research Laboratory.—*Urginea Burkei.*

Dominica Botanic Garden.—Seeds of *Attalea Cohune*, *Syagrus* sp. and *Raphia vinifera.*

Arnold Arboretum.—Many hardy trees and shrubs, including *Taiwania cryptomerioides;* many packets of seeds, including *Lilium cernuum.*

Darjeeling, Lloyd Botanic Garden.—432 packets of seeds collected in the mountains, including *Castanopsis hystrix* and *Aesculus pundeana.*

Sydney Botanic Garden.—Seeds of Eucalypti, &c.

Pretoria Department of Agriculture.—Stapelias, bulbs and seeds of 38 species of *Aloe; Brachystelma* sp.

Nairobi Forestry Department.—*Euphorbia* sp., *Cyrtanthus* sp., *Amomum* sp., *Crinum* sp., and 4 species of *Asparagus; Buddleia salviaefolia.*

Pekin Forestry Department.—Seeds, 12 species trees and shrubs.

La Mortola (the late Lady Hanbury).—156 packets of seeds.

Mauritius Botanic Garden.—Seeds of 14 species of palms.

Queenstown Public Gardens, S. Africa.—Stems of *Encephalartos Frederici-Guilielmi*, tuber of *Amorphophallus*, and *Kniphofia* sp.

National Botanic Garden, Kirstenbosch, Cape Town.—Three species of *Aloe.*

Uganda Botanic Garden.—32 packets of seeds, tubers of Orchids.

Grenada Botanic Garden.—32 plants of *Danaea.*

Egyptian Ministry of Agriculture, Hort. Sect., Giza.—Various seeds, including *Nelumbium speciosum*.

Florence Institute of Forestry.—Various seeds, plants and cuttings.

Macgregor Museum, Kimberley.—*Caralluma lutea*.

Khartoum Palace Gardens.—*Aloe* sp., *Euphorbia venenifera*.

Major L. de Rothschild, St. Swithin's Lane.—Many packets of seeds collected by Farrer.

Mr. C. Eley, East Bergholt.—Seeds collected by Forrest.

Mr. A. K. Bulley, Neston.—Seeds collected by F. K. Ward.

Mr. J. C. Williams, Caerhays.—Seeds collected by Forrest.

Mr. R. Farrer (the late).—Seeds of 20 species of Rhododendron.

Messrs. Charlesworth & Co., Haywards Heath.—Orchids.

Mr. R. H. Beamish, Ashbourne.—Seeds of *Corylus tibetica*; various herbaceous plants.

Duke of Bedford, Woburn.—*Larix pendula*.

Sir E. G. Loder (the late), Leonardslee.—Seeds of *Glyptostrobus heterophyllus*.

Mr. H. Blanchard, Parkstone.—Seeds of *Telopea oreades*.

Messrs. Boustead & Co., Leadenhall St.—Seeds from Brazil.

Mr. G. W. E. Loder, Wakehurst Place.—Seeds *Rhodoleia Championae*; *Ranunculus insignis*; various shrubs; *Ficus Krishnae*, etc.

Mr. W. R. Price, Chepstow.—13 kinds of *Meconopsis* and 7 of *Primula* from Forrest's seeds.

Mr. Bethune, Strathpeffer.—*Senecios Smithii*.

Mr. A. L. Allen, St. James' St.—Seeds and plants of 12 species of *Mesembryanthemum* and *Aloe*.

Mr. H. A. Moore, Saintfield.—Chinese Rhododendrons.

Donard Nursery Co., Co. Down.—Various trees and shrubs.

Mr. H. J. Elwes, Colesborne.—*Arisaema utile*, large plant of *Puya chilensis*.

Mrs. Lechmere, Hampton.—51 packets of seeds from Kashmir.

Dr. Bedford, York.—Various Orchids.

Mr. N. E. Brown, Kew.—Stapelias and Mesembryanthemums.

Messrs. Sander and Sons, St. Albans.—Large plant of *Vanda luzonica*; seeds of *Leucadendron argenteum*; various stove plants.

Prof. A. Henry, Dublin.—Seeds of *Pseudotsuga Douglasii* var. *caesia*.

Maj. F. C. Stern, Goring-by-Sea.—*Lonicera Hemsleyana*, *Papaver* sp., *Lilium Brownii*? etc.

Hon. Vicary Gibbs, Elstree.—Herbaceous plants.

Mr. J. S. Gamble, East Liss.—*Pinus Bungeana*.

Mr. S. Mallock, Exeter.—*Asplenium Hemionitis*.

Sir H. A. Wickham, Royal Colonial Inst.—Three packets of seeds; plants of *Bilbergia*, *Agave* and *Furcraea*.

The O'Mahoney, Wicklow.—Seeds of "Scarlet Furze" from Patagonia.

Sir Arthur Brown, Farnham.—*Hoya burmanica*.

Prof. W. G. Craib, Aberdeen.—Gooseberry × Blackcurrant.

Miss M. A. Rogers, Bournemouth.—Large plant *Aloe Bainesii*.

Mr. T. Wylde, Putney.—Tuber of *Amorphophallus* from Rhodesia.

Mr. W. J. C. Frost, Fulham.—*Cypripedium Mastersianum*.

Mr. A. E. Bowles, Waltham Cross.—Herbaceous plants.

Messrs. Lee & Co., Lime St.—Bromeliads and Orchids from Colombia.

Mr. A. M. Mitford, Upton Park.—*Macrozamia, Anona, Diospyros*; various seeds.

Mr. R. Cory, Cardiff.—Hybrid Cordylines.

Mr. R. B. Rogers, Launceston.—*Larix Potanini, Juglans regia racemosa*, white fragrant *Cyclamen*.

Mr. A. Grove, Henley-on-Thames.—Seeds of *Paeonia Delavayi* and *Lilium mirabile*.

Mr. R. N. Parker, Chamba, Punjab.—Seeds of *Abies Webbiana* var., *Jasminum Parkeri, Alnus nepalensis*, etc.

Miss Mason, Cape Town.—Various native bulbs and seeds.

Prof. Trelease, St. Louis.—Seeds of *Agave cupreata*.

Messrs. Vilmorin-Andrieux & Co., Paris.—Various plants and seeds.

Mr. G. Fraser, Ucluclet, Canada.—Hybrid *Lonicera, Rhodora* and *Azalea*.

Mr. M. T. Dawe, Bogota.—Various Orchids and Seeds.

Mr. R. Fyffe, Entebbe, Uganda.—Various seeds; tubers of *Lissochilus* and an Irid.

Mr. N. H. Cowdry, Pekin.—26 packets of Chinese seeds.

Mr. W. B. Alexander, Swan River, Australia.—Seeds of *Macrozamia Frazeri, Melaleuca, Boronia* and *Eucalyptus*.

Mr. C. H. Lankester, Costa Rica.—Various Orchids, Bromeliads, etc.; *Peristeria elata*.

Mrs. Addison, Sierra Leone.—*Heamanthus multiflorus*.

Dr. C. Skottsberg, Gothenburg, Sweden.—20 packets of seeds from Juan Fernandez.

Mr. C. R. Orcutt, California.—*Echinocereus Orcuttii* and *Hassianthus Orcuttii*.

Mr. J. A. Peterson, Cincinnati.—Begonias.

Mr. C. Maniques, Santiago.—Seeds of *Lomatia obliqua* and *Nothofagus Dombeyi*.

Rev. J. Roscoe, Uganda.—*Crinum* sp., various seeds.

Mr. E. C. Villiers, Ceylon.—*Anoectochilus regalis, Cannas*, various bulbs.

Mr. J. Burtt-Davy, Pretoria.—Seeds of *Jubaeopsis caffra*.

Mr. H. Johnson, Guatemala.—Seeds of *Epiphyllum pumilum*.

Mr. D. Tannock, Dunedin.—Seeds of Celmisias, etc.

Mr. T. F. Bourdillon, S. India.—Seeds of *Strychnos cinnamomifolia*.

Mr. J. Wilson, Buenos Aires.—Seeds of *Quebrachia Lorentzii*.

Madame Perez, Teneriffe.—A quantity of seeds of *Juniperus Cedrus*.

Lt.-Col. Lee, Burma.—*Lilium sulphureum*.

Dr. R. Marloth, Sutherland, S. Africa.—Two species of *Duvallia*.

Mr. P. Chandler, Uganda.—32 packets of seeds.

Mr. J. S. Dash, Station Agronomique, Guadaloupe.—Seeds of *Sesbania sericea*.

Surplus plants from the collections were distributed as usual, either in exchange with botanic gardens, nurserymen, etc., or as gifts to various teaching institutions, and there was the usual distribution of seeds produced by the cultivated plants. The total number of packets thus distributed was 1,696 of hardy trees and shrubs and 2,217 of hardy herbaceous plants. The most important of the seeds obtained for special distribution were: *Abies brevifolia* var. *Webbiana*, *Dipterix odorata*, *Stenocarpus sinuatus*, *Lomatia obliqua*, *Sesbania sericea*, *Magnolia Wilsoni*, *Quebrachia Lorentzii*, *Aesculus indica*.

The recipients of plants, etc., from Kew included the following :—

Duke of Bedford, Woburn.—Trees and shrubs.

Lord Harcourt, Nuneham.—Trees and shrubs.

Hon. Vicary Gibbs, Elstree.—Herbaceous plants.

Rev. R. W. C. Hurst, Wheatley.—Collection of species of *Rosa*.

Miss Willmott, Warley.—Trees and shrubs.

Major Hurst, Burbage.—100 species of *Rosa*.

Major L. de Rothschild, Exbury.—Rhododendrons and other shrubs.

Col. D. V. Pirie, Eaton Square.—Trees and shrubs.

Mr. H. J. Elwes, Colesborne.—Succulent plants, etc.

Trinidad Botanic Gardens.—Collection of succulents.

H.E. The Governor, Falkland Islands.—Cuttings of Poplars and Willows; seeds of trees.

Glasnevin Botanic Gardens.—Trees, shrubs and indoor plants.

Cambridge Botanic Garden.—Collection of plants.

Cyprus, Department of Agriculture.—Seeds of sub-tropical plants.

Jardin des Plantes, Paris.—Many trees and shrubs.

Richmond Park.—Many trees and shrubs.

National Physical Laboratory, Teddington.—300 trees and shrubs.

Hampton Court Gardens.—1,500 trees and shrubs.

Imperial War Graves Commission, France.—5,000 cuttings of trees and shrubs.

Heston Hospital.—Trees and shrubs.

Blackheath High School.—Trees and shrubs.

Chiswick County School.—Trees and shrubs.

Putney County School.—Trees and shrubs.

Bedale's School, West Drayton.—Trees and shrubs.

Tudor House, Newington.—Trees and shrubs.

Internal painting and repairs in the South Wing of the Palm House and the Mexican Wing of the Temperate House neces-

sitated the closing of these two structures to the public for a portion of the year. The beds in the Temperate House have been largely replanted and the *Musa* collection in the Palm House has been restarted in a specially prepared border. The beds in No. 1 House have been renovated. The Succulent House (No. 5) has been thoroughly overhauled and some of the largest specimens retubbed. The festoon of ivy surrounding the Range Terrace having become worn out, it has been replaced by a collection of Wichuraiana Roses supported on iron pillars and chains. Owing to the heavy fogs experienced in November--December, a sticky layer of soot, etc., was deposited on the glass roofs, which had to be washed with mops. The effects of the fog on the collections under glass were worse than anything experienced for many years. The leaves of many plants, particularly Begonias, fell off, and the flowers and buds of the majority of plants which bloom in winter were spoilt.

Arboretum.—The large and continuous influx of new Rhododendrons, chiefly from China, has rendered the provision of more space for them necessary. Another of the slopes of the mound on which King William's Temple stands has been cleared of a miscellaneous plantation of shrubs and planted with various representatives of this genus, a few of the larger trees being left to provide the shade many species of *Rhododendron* delight in. Thanks to the generosity of various friends of Kew, especially Mr. J. C. Williams and Mr. Lionel de Rothschild, M.P., a great number of seedlings of new species are now in the nursery, raised from seed collected by Mr. Forrest and the late Mr. Reginald Farrer. How far they will be adapted to the climatic and other conditions of Kew has yet, of course, to be proved.

The removal of a deodar which stood at one corner of the Water-lily Pond has provided an opportunity of enlarging the area and improving the outline of this popular feature of Kew. Mr. L. de Rothschild has kindly promised to provide Kew with a selection of the best varieties from his fine collection of hardy Nymphaeas at Gunnersbury.

About half the potato plot in front of Kew Palace was sown with grass seed and made into lawn again, the remainder being cropped with Up-to-date potatoes. Considering that this was the third potato crop taken from this piece of ground in successive years without manure, the yield was very good, although somewhat reduced by disease.

Although there was a good crop of grass, the weather during June and July was so unsettled that the harvesting proved very troublesome, and much of the hay was of very inferior quality.

The removal of a few superfluous common trees near the collection of beeches has enabled us to give more space to young trees recently acquired. In 1902, when the last edition of the 'Hand-list of Trees and Shrubs" was published, the collection

of *Fagus* at Kew consisted only of *F. sylvatica*, *F. ferruginea* and their varieties. Since then this genus has been considerably augmented and the following species are now growing in the open air at Kew :—

F. Engleriana, Seemen.
F. japonica, Maxim.
F. orientalis, Lipsky.
F. sylvatica, Linn.
F. ferruginea, Aiton.
F. longipetiolata, Seemen.
F. Sieboldii, Endl.

Of the Southern beeches, now generally regarded as generically distinct under *Nothofagus*, the following are growing in the open air at Kew :—

N. antarctica, Oerst.
N. betuloides, Blume.
N. procera, Oerst.
N. Dombeyi, Blume.
N. obliqua, Blume.

Fagus lucida, Rehd. et Wilson, of which some living plants were brought to the Arnold Arboretum by Mr. E. H. Wilson from Western Hupeh in 1911, Kew does not yet possess.

In February about 1,500 trees and shrubs were supplied to the Hampton Court Gardens, and in December about 300 for planting in the grounds of the National Physical Laboratory at Bushey Park.

Museums.—It is gratifying to record that the Museums are increasingly used not alone by students, but by commercial firms and others engaged in the development of the vegetable resources of the Empire. The demands of correspondents are extremely varied and often of a complex nature, quite in keeping with the miscellaneous products submitted for determination, report, and for references to literature, etc. In critical examination of many of the more difficult subjects, the Assistant Keeper of the Jodrell Laboratory has given most valuable aid. Much has been done to improve the collections. The donations have been more numerous than of recent years and many most valuable additions to the Museums were generously presented by exhibitors at the Empire Timber Exhibition held at Holland Park during the summer. In this connection it should be recorded that a selection of home-grown timbers from Museum No. IV. was included in the exhibition, and the services of Mr. W. Dallimore, an Assistant in the Museums, who represented the Royal Botanic Gardens on the Committee for the Home-grown timber exhibit, were greatly appreciated by the authorities. A selection of duplicate material was also sent to the Bath and West and Southern Counties Show, and later transferred to the Royal Counties Show. A collection of water-colour drawings representative of the vegetation of Southern and Eastern Africa made there by Miss M. H. Mason and presented by her to the Royal Botanic Gardens has been framed and placed on exhibition on the upper floor of Museum IV.

J. M. H.

Presentations to Museums.—The following miscellaneous specimens have been received in addition to those previously recorded in the *Bulletin* :—

The Explosives Trades, Ltd., Cavendish Square, London.—Case containing specimens illustrating the extraction of tree stumps by explosives.

Messrs. Gabriel Wade and English, Ltd., Commercial Road, Lambeth.—Samples of Elm treated with a patent process and marketed as Greywood.

The Chief, Division of Botany, Pretoria. Gum from *Combretum erythrophyllum.*

Mr. H. J. Elwes, F.R.S., Colesborne, Gloucester.—Garment woven from the bark of a species of *Ulmus* by Ainos of Hokkaido, also a rope of the same material used for carrying burdens.

Dr. T. A. Henry, The Wellcome Chemical Research Laboratory, London.—Sample of oil of *Jessenia polycarpa*, Colombia.

Messrs. John Eede Butt and Sons, Littlehampton. Plank of Service Tree (*Pyrus Sorbus*).

Messrs. Box and Turner, Ardingly.—Various articles made of Oak and Ash.

Messrs. J. and P. Coats, Ltd., Glasgow.—Exhibition case containing a set of Birch spools.

Messrs. B. Horton and Son, Westerham, Kent.—Oak laths and palings.

Messrs. J. Stenning and Son, Ltd., East Grinstead.—Window sills of Oak, Wrest planks of Beech, etc.

Messrs. John Sadd and Sons, Ltd., Malden, Essex.—Panel and mantel-piece of Brown Oak, wheel hubs of Oak and Elm and various other articles.

Messrs. Robert Batcheller and Sons, Ltd., Maidstone.—Railway keys and trenails.

The Wood Wool and Fibre Co., Ltd., Hackney Wick, London, E.—Samples of Wood Wool prepared from Poplar.

Messrs. Thomas James, Ltd., Bermondsey.—Spokes made of Oak.

Messrs. William Stenning and Son, Red Hill.—Plane Blocks of Beech.

Mr. H. Rossiter, Bittern Street, Boro.—Samples of Hut Blocks of various woods.

Messrs. R. Groom, Sons & Co., Wellington, Salop.—A large assortment of turned and other articles of woodware, chiefly for household and dairywork.

Mr. Patrick Green, Ingatestone, Essex.—Tinplate boxes made of Elm.

Messrs. E. W. Turner and Son, Ltd., Bloxwich.—Set of Oak wagon scantlings.

Messrs. Oates, Ltd., Worksop.—Tool handles made of Ash and of Sweet Chestnut.

Messrs. Wilson Bros., Bobbin Co., Ltd., Garston, Liverpool.—Large case, containing bobbins of various home-grown woods in different stages of manufacture.

Mr. Milne-Home, Canonbie.—Sections of a young tree of Japanese Larch.

The Rt. Hon. F. D. Acland, Forestry Commission, Grosvenor Gardens, London.—Plank of Scots Pine from a tree grown in Devonshire.

Mr. H. C. Eyles, Office of Woods, Regent's Park.—Two planks and a transverse section of *Cedrus Deodara* from the Forest of Dean.

Mr. John Roberts, Tintern.—Various articles turned from Coppice wood.

Mr. J. Burtt-Davy, Kew.—A miscellaneous collection of articles from South Africa.

The Crown Agents for the Colonies.—A selection of planks of Colonial Timbers from the Empire Timber Exhibition, Holland Park.

Mr. C. A. Benn, Kington, Hereford.—Plank from a tree of *Abies nobilis*, which attained a height of 83 ft.

Mr. M. T. Dawe, St. James' Square, London.—Sample of wood of Comino crespo (*Aniba perutilis*), series of specimens and photographs to illustrate the manufacture of Panama hats, also samples of Balata, Gum Chicle, and various other Colombian products.

Superintendent, Small Arms Factory, Enfield Lock.—Examples of gun stocks as exhibited at the Empire Timber Exhibition.

Sir D. Morris, K.C.M.G.—Cones of *Pinus Morinda* from West Dorset.

The Incorporated Oil Seed Association, St. Mary Axe.—Samples of Chinese Galls (*Rhus semialata*) and six samples of oil seeds.

Mr. M. Ruben, Scrutton Street, London.—Panel of finely figured Satinwood.

Capt. Loutit, M.C., Aberdeen.—Three sections of Bog Oak from a peat bog at Ardo, Aberdeenshire. J. M. H.

Research in Jodrell Laboratory in 1920.—Mr. L. A. Boodle made some experiments with bamboo in relation to attack by boring beetles, and continued some observations on the development of the ovule in an *Aroid*.

Dr. C. J. F. Skottsberg examined some points in the structure and development of the thallus in *Splachnidium*.

Dr. J. C. T. Uphof began a study of the comparative anatomy of several species of *Davallia*.

Prof. F. E. Weiss compared the anatomical structure of certain graft-hybrids with that of the parent plants.

Mr. W. C. Worsdell completed a study of the anatomy of the *Polygonaceae*.

Presentations to the Library during 1920.—The Bentham Trustees have presented 16 herbals published between the years 1529 and 1744. These include the first edition (1557) of Adam Lonicer's *Kreuterbuch*, in which several of the figures have been crudely coloured, and the edition of 1578; an excellent copy of Dioscorides, *De Materia Medica libri v.*, 1529–30, with Greek and Latin text in parallel columns, the edition published at Salamanca in 1586 "traduzido . . . en la vulgar Castellana," and the octavo Spanish edition, translated by Juan Jarava, and published at Antwerp in 1557; Mattioli, *Discorsi ne' sei libri di P. Dioscoride della materia medicinale*, Venice, 1744, and the French edition of Mattioli's Commentaries, dated 1566; a good copy of the apparently rare edition cf Dodoens' *Cruydt-Boeck*, printed at Leyden in 1618 by F. van Ravelingen; Malpighi's *Opera posthuma*, 1697; Poppe's *Kräuterbuch*, 1625; Brasavola, *Examen omnium simplicium medicamentorum, quorum in officinis usus est*, 1539; La Brosse, *De la nature, vertu, et utilité des plantes*, 1628; Rhagor, *Erneuerter Pflantz-Garten*, 1669; and Durante, *Herbario novo*, 1667.

From the Trustees of the British Museum have been received the fourth volume of Fawcett and Rendle's *Flora of Jamaica*; *Birds Beneficial to Agriculture*, by F. W. Frohawk; and *Marine Boring Animals Injurious to Submerged Structures*, by W. T. Calman.

The Director-in-Chief of the New York Botanical Garden, Dr. Britton, has completed the Kew set of the *Contributions from the New York Botanical Garden*, and has sent the continuation of the *North American Flora*; he has also presented the second volume of the splendid work by him and Dr. J. N. Rose on the Cactaceae, and a copy of *The Bahama Flora*, by him and Dr. C. F. Millspaugh.

Mr. J. H. Maiden has presented, in addition to several of his pamphlets, parts 39–43 of his monumental work on *Eucalyptus*. Parts 63 and 64 of his *Forest Flora of New South Wales* have been received from the Secretary for Agriculture.

Numerous presentations have been made by Lieut.-Col. Sir David Prain, including:—*Travaux du Laboratoire de Matière Médicale de l'École Supérieure de Pharmacie de Paris*, Tome xi; 36 papers on Papaveraceae, by F. Fedde; *National Antarctic Expedition, 1901–1904: Album of Photographs, &c.*, published by the Royal Society; *Contribution à l'étude anatomique de la famille des Ternstroemiacées*, by L. Beauvisage; *Frost und Licht als beeinflussende Kräfte bei der Samenkeimung* (Supplement 2), by W. Kinzel; and recent issues of the *Berichte der Deutschen Botanischen Gesellschaft* and of the *Bulletin de la Société Botanique de France*.

Capt. A. W. Hill has presented a copy of *The English Rock Garden*, by the late Reginald Farrer; the first part of *The Flowering Plants of South Africa*, edited by I. B. Pole Evans; and several pamphlets.

From Dr. Otto Stapf have been received 15 issues of the *Jahresbericht der Gesellschaft zur Förderung der naturhistorischen Erforschung des Orients in Wien.*

Prof. Hans Schinz has continued to send the *Mitteilungen aus dem Botanischen Museum der Universität Zürich* of which nos. 82, 83, 85–88 have been received. He has also presented the second part of the Botany, edited by himself and Mr. A. Guillaumin, of the work on New Caledonia by F. Sarasin and J. Roux.

Contributions too numerous to specify here have been received from several institutions besides those already mentioned, the more important being :—the Smithsonian Institution, the United States Department of Agriculture, the Gray Herbarium and Arnold Arboretum of Harvard University, the Osborn Botanical Laboratory of Yale University, the Cornell University Agricultural Experiment Station, the Agricultural Research Institute, Pusa, the Ministry of Agriculture, Egypt, the Departments of Agriculture of Buitenzorg, New Zealand, and the Union of South Africa, the College of Science of the Imperial University of Tokyo, the Botanical Library of the University of Copenhagen, the Landbouwhoogeschool, Wageningen, and the Station of Vegetable Pathology, Paris. The Bureau of Forestry, Government of Formosa, has sent the ninth volume of the *Icones Plantarum Formosanarum*, by B. Hayata; and the New Zealand Institute, vols. 48, 49 and 50 of its Transactions, as well as two parts of the Bulletin on Mosses, by H. N. Dixon. The Crown Agents for the Colonies have presented the second edition of the *Handbook of Uganda*, by H. R. Wallis; and from the South African Biological Society have been received two numbers of its Bulletin and two numbers of *The South African Journal of Natural History.*

Mr. Oakes Ames is continuing his *Studies in the Family Orchidaceae*, and just recently has presented a copy of the sixth fascicle; also a separate set of the illustrations in it for the Kew collection of drawings. A further valuable addition to this collection, made by Dr. J. J. Smith, is a set of nearly 200 of his published plates, chiefly of Orchidaceae. Dr. Smith has also presented 12 of his papers.

From the publishers have been received *The Nature-study of Plants*, by T. A. Dymes (S.P.C.K.), and *The Centenary Volume of Charles Griffin and Company, Ltd.*

A small duodecimo, entitled : *Œuvres du Marquis de Villette*, which was published in London in 1786, has been presented by Mr. G. H. Wollaston. The interest attaching to this volume, as far as Kew is concerned, is due to the fact that the paper used for it was made from the bark of the lime-tree, and that, bound in at the end, are 21 leaves made from the wood or bark of other plants, the French names of which are printed on the leaves themselves. Among the plants represented in this way are the mallow (probably *Althaea officinalis*), hop, nettle, willow, oak, poplar, hazel, spindle-tree, dog's-tooth grass, common reed,

elm, burdock, colt's-foot, algae, a moss, and a thistle. The paper from the mallow is distinctly the best.

Dr. L. H. Bailey has presented the first issue of his *Gentes Herbarum;* also *Annals of Horticulture in North America*, 1891, completing the Kew set; and *Blackberries of New England—their classification*, by E. Brainerd and A. K. Peitersen.

From Mr. R. T. Baker, who, in collaboration with Mr. Henry G. Smith, had previously produced two fine quartos, one, *A Research on the Pines of Australia*, and the other, *A Research on the Eucalypts, especially in regard to their essential oils*, has published and presented a copy of a third volume,*The Hardwoods of Australia and their Economics.*

The following have been received from their respective authors or editors:—*Étude . . . de la famille des Turnéracées*, by M. G. Berger; *Dr. S. H. Koorders:* [An account of his life and work], by E. H. B. Brascamp; *Pflanzenphänologische Beobachtungen in Finland*, by V. F. Brotherus, 1912–1913, and other papers; *Révision des Cypéracées de Madagascar*, by H. Chermezon; *A monograph of the genus Dryopteris*, by Carl Christensen, part 2; *Eubasidiomycetes Lusitanici Herbarii Universitatis Olisiponensis*, by A. X. P. Coutinho; *Mission forestière et agricole du Comte Jacques de Briey au Mayumbe (Congo Belge)*, by E. De Wildeman, who has also presented several of his smaller works; *An account of the Herbarium of the University of Oxford*, by G. C. Druce and S. H. Vines, from Dr. Druce; *Insect Pests and Fungus Diseases of Fruit and Hops*, by P. J. Fryer; *Economic Trees and their By-products*, and *The Soil and its care*, by Mrs. M. Grieve; *Forests, Woods and Trees in relation to Hygiene*, by Augustine Henry; *Pastimes for the Nature Lover*, by Stanley C. Johnson; *The Botany of Iceland*, edited by L. Kolderup Rosenvinge and Eug. Warming, vol. ii, part 1; *Revision crítica e iconográfica de las plantas barrilleras de España*, by B. Lázaro e Ibiza; *Pine-apple Disease of Sugar Cane*, by T. Miyake; *Flora sylvatica Koreana*, part 8, and *Report on the Vegetation of the Island Ooryongto or Dagelet Island, Corea*, by T. Nakai; *The Vegetation of Northern Cape Breton Island, Nova Scotia*, by G. E. Nichols; *Practical Plant Biochemistry*, by Mrs. M. Wheldale Onslow; *Las Chlorideas de la República Argentina*, by L. R. Parodi; *Gli Arboreti Sperimentali di Vallombrosa*, by L. Piccioli; *Two preglacial Floras from Castle Eden*, &c., by Mrs. Clement Reid; *Phanerogamic Flora of the Divisions of Uitenhage and Port Elizabeth* (Memoir no. 1 of the Botanical Survey of South Africa), by S. Schonland; the same, and a copy of the Dutch edition, from Dr. I. B. Pole Evans, Director of the Survey; *The Natural History of Juan Fernandez and Easter Island*, edited by Carl Skottsberg, vol. ii (Botany), part 1; *The Travels of Peter Mundy in Europe and Asia*, edited by Lt.-Col. Sir R. C. Temple, Bt., vol. iii; *Index to the Genus Rhododendron*, by E. H. Wilding; *Journal of Archibald Menzies kept during his three visits to the Sandwich or Hawaiian Islands in the years 1792–1794*, edited and annotated by W. F. Wilson.

Among others who have made presentations to the Library the following should be mentioned as the donors of papers by themselves, or, in a few cases, of other publications :—Dr. S. Agharkar, Prof. E. B. Babcock, Dr. P. A. van der Bijl, Prof. S. R. Bose, Mr. H. S. Carey (*The Carices of the Northern United States*, by John Carey, with MS. additions by the author), Dr. E. Chiovenda (5 papers), Prof. R. Chodat (numerous publications from the Institute of Botany, University of Geneva), Mr. J. L. Collins, Mr. M. T. Dawe, Dr. L. Diels (9 papers), Mr. H. N. Dixon (*Lichens du Mexique*, by M. Bouly de Lesdain), Mr. Kinsley D. Doyle (*Contribución al conocimiento de los arboles de la Argentina*, by S. Venturi and M. Lillo), Mr. S. T. Dunn (2 papers, by N. H. Cowdry), Lt.-Col. F. R. Durham (*Excursionsflora für Tölz und Umgebung*, by A. Hammerschmid), Mr. Gunnar Erdtman, Dr. I. B. Pole Evans, Dr. C. E. Fairman, Mr. O. A. Farwell, Mr. J. S. Gamble (76 pamphlets by various authors), Mr. R. W. T. Gunther, Prof. R. A. Harper, Prof. L. Hauman, Mr. A. Howard, Lady Hooker (several publications of the Royal Academy of Belgium), Prof. F. Kränzlin (21 papers); Prof. G. Lagerheim (*Studien über Konstruktions-typen und Entwicklungswege des Embryosackes der Angiospermen*, by B. Palm), Mr. C. G. Lloyd, Capt. J. Loutit (*The British Gardener's Director*, by J. Justice), Dr. D. T. MacDougal, Prof. C. Massalongo, Mr. W. R. Maxon (numerous *Contributions from the United States National Herbarium*, and other papers), Prof. T. G. B. Osborn, Dr. E. P. Phillips, Mr. T. A. Sprague (*Russia*, by D. Mackenzie Wallace, 2 vols., and a MS. *Flora of Timbuctu*, compiled from the works of Dr. Aug. Chevalier), Dr. R. Stockman, Mr. Gunnar Täckholm, Dr. J. C. Th. Uphof, and Mr. C. T. White.

Additions to the Herbarium during 1920.—During the year about 19,900 specimens were received as donations or exchanges and 12,499 purchased, while 2,828 were received on loan. The principal collections are enumerated below :—

EUROPE.—*Presented :* Britain : Cornish plants, by Mr. Edgar Thurston; British Rubi, by Mr. E. Langley; various British and continental plants, by Mr. C. E. Salmon; Pyrenees and Corsica, by Dr. Michel Gandoger; Austria, Kryptogamae exsiccatae, centuries 22–24, by Dr. A. Zahlbruckner; Macedonia, by Mr. Lyon V. Turner.

Purchased : Dr. H. Dahlstedt, Taraxaca Scandinavica Exsiccata, fascicle vi. 1; H. Sydow, Mycotheca Germanica, fascicles 25–27; Adr. Fiori and A. Béguinot, Flora Italica Exsiccata, centuries 23–24, and Xylotomotheca Italica, nos. 131–150; Dr. M. Gandoger, Crete and Syra. A. Leithe-Jasper, Tyrolese Cryptogamia.

ORIENT.—*Presented :* Mesopotamia, collected by members of the Baghdad Department of Agriculture, per Lt.-Col. R. J. D. Graham.

China.—*Presented :* Canton (C. O. Levine), by Mr. C. W. Howard; Chefoo, by Mr. N. H. Cowdry.

India.—*Presented :* British Lahul, Pangi and Garhwal, by Shiv Ram Kashyap: Assam, Abor Hills, by Mr. I. H. Burkill; Chamba State, by Mr. R. N. Parker; Dehra Dun, by Mr. S. H. Howard; Ootacamund, by Lady E. T. Bourne.

Malay Peninsula.—*Presented :* Various localities, by Mr. F. W. Foxworthy; Cryptogamia, by Mr. T. F. Chipp; Singapore Palms, F. Flippance, by Mr. H. N. Ridley; Fungi Malayana, century 6, by Mr. C. F. Baker.

Malaya.—*Presented :* Siam, by Dr. A. F. G. Kerr, Mrs. D. J. Collins and Mr. A. Marcan; Philippines, by Mr. E. D. Merrill; Borneo, Mt. Kinabalu, by Mr. Oakes Ames and Mr. E. D. Merrill; Java, by the Director of the Buitenzorg Botanic Garden; New Guinea, by Mr. C. T. White.

Purchased : A. D. E. Elmer, Philippines.

Australia.—*Presented :* Various localities, by Mr. J. H. Maiden and Mr. C. T. White.

Purchased : W. A. Weymouth, Tasmanian mosses.

New Zealand.—*Presented :* Mosses (Robert Brown), by Mr. George Brown; Ferns, &c., by Dr. Donald Petrie.

Polynesia.—*Presented :* Fiji, by Mr. William Greenwood.

Tropical Africa.—*Presented :* Gold Coast and Lagos, by Dr. J. M. Dalziel; Nigeria, Southern Provinces, by Mr. W. H. Johnson and Mr. P. A. Talbot; Congo Region, by Dr. E. De Wildeman, and Fungi (F. W. H. Migeod), by Messrs. Lever Bros.; Uganda, by Mr. R. A. Dummer, and the Mackie Ethnological Expedition (Coll. Rev. J. Roscoe); British East Africa, by Mr. W. J. Dowson; Masai Reserve (W. J. Dowson), by the Director of Agriculture, Nairobi: Portuguese Maiomhe, by Mr. J. Gossweiler; Rhodesia, by the Rhodesian Department of Agriculture, Mr. F. Eyles and Mr. A. Hislop.

Purchased : R. A. Dummer, Uganda.

Mascarene Islands.—*Presented :* Mauritius, by Mr. H. A. Tempany.

South Africa.—*Presented :* Transvaal, by Dr. I. B. Pole-Evans, Division of Botany, Department of Agriculture, Pretoria; Griqualand East, by Miss M. Wilman.

North America.—*Presented :* Grasses, centuries 5–7, by the United States Department of Agriculture; various, by the United States National Museum, per Dr. J. N. Rose.

Purchased : W. R. Smith, Canadian mosses.

Central America.—*Presented :* Costa Rica, by Mr. C. H. Lankester.

West Indies.—*Presented :* Jamaica, &c., by the Director-in-Chief, New York Botanical Garden; Dominica, by Mr. Joseph Jones.

South America.—*Presented :* Colombia, by Mr. M. T. Dawe, Mrs. I. A. Tracey and Dr. N. L. Britton; Juan Fernandez, by Dr. and Mrs. Skottsberg.

Purchased : Walter Fischer, Argentine.

Mr. Edgar Thurston, C.I.E., has presented the Cornish plants, collected during 1919, for incorporation in his Cornish herbarium now at Kew. Additional rare and critical British plants have been received from Mr. C. E. Salmon, F.L.S. Mr. E. Langley has contributed an interesting set of Bedfordshire Rubi named by the Rev. W. Moyle Rogers. A large collection from Mesopotamia made by the members of the Baghdad Department of Agriculture has been received from Lt.-Col. R. J. D. Graham. Mr. N. H. Cowdry has sent a continuation of his Chinese collections, this year made in the neighbourhood of Chefco. Lady E. T. Bourne has presented plants collected in Octacamund since the presentation by her and Sir A. G. Bourne in 1915 of their Indian herbarium. Various critical plants for determination have been received from the Forestry College and Institute, Dehra Dun, through Mr. S. H. Howard. Mr. R. N. Parker has sent several collections made by him in the Chamba State. Major T. F. Chipp, Assistant Director of the Botanic Gardens, Singapore, has forwarded Cryptogamia collected by him in the Malay Peninsula. Collecting in that region by Mr. F. W. Foxworthy and others has also been going on actively under the auspices of the Director of Museums, Federated Malay States, collections having been made in Pahang, Selangor and Negri Sembilan. In Siam, Dr. A. F. G. Kerr, after being on active military service in Europe, has resumed collecting in the district of Bangkok. Mr. E. D. Merrill has sent a large collection of Philippine plants, including 975 fungi, also 1,062 specimens of plants recorded in his "Species Blancoanae," published in Manila in 1918; he has also presented a collection made on Mt. Kinabalu, by Mrs. Clemens, from which locality orchids have been received from Mr. Oakes Ames. The Director of the Botanic Garden, Buitenzorg, has communicated an interesting collection of Javanese plants. Mr. J. H. Maiden, Director of the Botanic Garden, Sydney, has presented Australian plants, especially new or critical species of Acacia and Eucalyptus. Mr. W. Greenwood has forwarded the collections of flowering plants and mosses made by him in Fiji. Tropical Africa has yielded many collections, amongst them being Rhodesian grasses from Mr. F. Eyles, plants from the Congo region by Dr. E. De Wildeman and those collected by the Rev. J. Roscoe during the Mackie Ethnological Expedition. Dr. I. B. Pole-Evans has continued to send South African plants, including a collection made by Dr. E. P. Phillips at Bethlehem, in the Orange River Colony. Ferns collected in Juan Fernandez by Dr. and Mrs. Skottsberg, on which a report was recently published, have been presented by the collectors. Mrs. E. G. Britton has continued to send interesting mosses from the Herbarium of W. Mitten.

A valuable set of photographs taken in Japan by Mr. E. H. Wilson have been purchased from Prof. C. S. Sargent.

Deficiencies in the collection of portraits of botanists and botanical collectors have been remedied by Dr. W. Rushton Parker, who has presented photographs of pictures in the National Portrait Gallery and elsewhere.

Botany of Juan Fernandez and Easter Island.*—A recently published report on the collections made by Dr. and Mrs. Skottsberg during the Swedish Expedition to Patagonia and Terra del Fuego in 1916 and 1917 contains three papers dealing respectively with (1) the Pteridophyta of the Juan Fernandez Islands; (2) the Ferns of Easter Island; and (3) the Myxomycetes of Juan Fernandez. The two first are by C. Christensen and C. Skottsberg, and the last by R. E. Fries. Up to 1908, 42 species had been recorded from Juan Fernandez, while the number now known is 51, of which 17 are endemic, and 2 species, known elsewhere, are represented by endemic varieties. One genus, *Thyrsopteris*, is endemic and does not occur at altitudes below 400 metres; for an account of this plant see *Kew Bulletin*, 1915, p. 295. Of the species recorded outside Juan Fernandez, 27 are also found on the continent of South America, 5 in tropical America, 6 in the Falkland Islands, 5 in New Zealand, and 5 on the Australian continent. Three others occur on islands in the southern ocean. Three are of wide distribution, viz.:—*Cystopteris fragilis*, Bernh., almost cosmopolitan; *Polypodium lanceolatum*, L., throughout the tropics, and *Elaphoglossum Lindenii*, T. Moore, tropical America. Some species also found in the Falkland Islands attain a high altitude in Juan Fernandez, two being found up to 1,370 metres, while *Serpyllopsis caespitosa*, C. Chr., and *Adiantum chilense*, Kaulf., extend up to 1,400 metres, the last named also going down to sea level.

Easter Island was visited in June, 1917, when all the ferns previously recorded were again collected as well as five additional ones, bringing the total for the island up to 12. Two are endemic; one of these, *Dryopteris Espinosai*, Hicken, had previously been collected by Mr. F. Fuentes; the other proved to be a new species, *Doodia paschalis*, allied to the Australian *D. blechnoides*, A. Cunn. Most of the other species have a wide distribution, and are of a more tropical type than those from Juan Fernandez, though the latter is only about 5° further south.

Thirteen genera of *Myxomycetes*, comprising 18 species, are enumerated from Juan Fernandez by Dr. R. E. Fries. None of these is endemic.

The report is illustrated by 5 plates and several text figures.

C. H. W.

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* *The Natural History of Juan Fernandez and Easter Island*, edited by Dr. Carl Skottsberg. Vol. II., Botany. Part i. Uppsala, 1920. Almqvist & Wiksells. 250 Swedish crowns.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 2] [1921

III.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS (I.).

JOSEPH BURTT-DAVY.

1. **Indigofera Buchananii,** *Burtt-Davy* [Leguminosae-Galegeae]; species *I. Guthriei,* Bolus, *I. gramineae,* Schltr., et *I. simplicifoliae,* Lam., affinis, sed fruticulus humilis, erectus vel decumbens, multiramosus, stipulis setaceis 3–6 mm. longis glandulosis, foliis brevissime petiolatis linearibus angustatis longe acuminatis vel mucronatis facile distinctus.

Herba perennis (?). *Caulis* erectus, aliquanto tenuis, 2·5–3·5 dm. (vel ultra?) altus, valde ramosus, castaneo-brunneus. *Rami* tenues, ex axillis omnium foliorum crescentes. *Stipulae* setaceae, 3–6 mm. longae, glandulosae. *Petioli* circiter 1 mm. longi. *Foliola* linearia, longe acuminata vel mucronata, 5–5·5 cm. longa, 3 mm. lata, plicata, marginibus glandulosis. *Flores* axillares; pedunculi filiformes, circiter 1 cm. longi, 1–4-flori. *Calycis* dentes anguste lanceolati vel subulati. *Corolla* circiter 6 mm. longa. *Legumen* valde tenue, circiter 2·5 cm. longum.

SOUTH AFRICA. Transvaal: Ermelo Dist.; Lion's Glen near Amsterdam, *J. B. Buchanan, T. D. A. Herb.* 4779 *in herb. Bolus.*

Native name: "M'Lumo"; supposed to be poisonous to live stock.

2. **Rhynchosia unifoliolata,** *Burtt-Davy* [Leguminosae-Phaseoleae]; species *R. Tottae,* Harv. (Fl. Cap. ii. 255), affinis, sed foliis saepe unifoliolatis et foliolorum forma differt.

Caules valde graciles, prostrati, ad basim ramosi. *Foliola* singula vel terna; foliolum terminale ovatum et acutum, 1·2–1·8 cm. longum, 8–9 mm. latum, reticulatum; petiolus 1–2 mm. longus; stipulae lanceolatae, 2·5–3 mm. longae. *Pedunculi* graciles, axillares, solitarii vel geminati, 2·5–4 cm. longi, floribus 1 vel 2; bracteae minutae. *Flores* 7–8 mm. longi; pedicelli valde breves. *Calyx* pubescens, lobis acuminatis.

SOUTH AFRICA. Transvaal: Ermelo Dist.; Ermelo, about 1620 m., *Burtt-Davy* 17403, *in herb. Bolus et Kew.* Standerton Dist.; Hoogeveld near Paardekopberg, *Rehmann* 6836.

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3. **Tephrosia Burchellii,** *Burtt-Davy* [Leguminosae-Galegeae]; species *T. capensi*, Pers. et *T. semiglabrae*, Sond. affinis, sed foliolis obovatis retusis mucronulatis distinguitur.

Herba tenuis, prostrata, pilis porrectis sparse hirsuta. *Caules* annui e collo perenni crescentes, 23–30 cm. longi, flexuosi, a basi ramosi, internodiis 4–5 cm. longis. *Folia* breviter petiolata, 5–7-juga, 4·5–5 cm. longa; rhachis pilis porrectis hirsuta; foliola 4–9 mm. distantia, obovata, retusa, mucronulata, 1–1·2 cm. longa, 5–7 mm. lata, glauca, ciliata, supra glabra, pagina inferiore sparse hirsuta praecipue in costa. *Stipulae* circiter 3 mm. longae. *Racemi* axillares, foliis longiores, floribus paucis (circiter 6); pedunculi longi et tenues. *Flores* circiter 6 mm. longi, 2 vel 3-tim aggregati, infimis fasciculis remotis. *Calyx* pilis longis et porrectis albescentibus hirsutus, lobis subulatis circiter 3 mm. longis. *Corollae* vexillum in dorso pubescens. *Legumen* 3–4 cm. longum, 3 mm. latum, falcatum, pilis appressis puberulum, stylo persistente rostratum.

South Africa. Cape Province: Griqualand W.; Hay Div., Griquatown, *Burchell* 1932 (type); "fields" near St. Clair, Douglas, Dec. 1896, *K. Orpen* 132A *in herb. Kew* Bechuanaland; Batlapin Terr., *Holub*. Orange Free State: Boshof Dist.; Smitskraal, *Burtt-Davy* 12905. Transvaal: Wolmaransstad, *Rogers* 18470; Bloemhof Dist., near Christiana, *Burtt-Davy*.

A common and characteristic plant of the Southern Bechuanaland Region, which has for some time been confused with *T. capensis*.

4. **Peltophorum africanum,** *Sond.*, var. **speciosum** *Burtt-Davy* [Leguminosae-Caesalpinioideae]; formae typicae affinis, sed floribus foliolisque majoribus differt.

Foliola circiter 17-juga, 1·3 cm. longa, 4–5 mm. lata, obtusa, mucronata vel emarginata, glabra vel sparse hirsuta, costa subtus prominente. *Flores* magni, flavi, speciosi. *Petala* 1·4 cm. longa, 1·2 cm. lata. *Legumen* ad 8 cm. longum et 3 cm. latum.

Tropical Africa. S. Rhodesia: Matopo Hills, *Dowsett in herb. Bolus*, 16426 (type). Mauritius: *Dep. Agric. herb.* 66 *in herb. Kew.*

A form intermediate between this and the typical South African tree occurs in Portuguese East Africa (Muchukwana, Lower Buzi River, 100 ft. alt., *Swynnerton* 1022).

5. **Acacia Nebrownii,** *Burtt-Davy* [Leguminosae-Mimosoideae]; *A. glandulifera*, Schinz in Mém. Herb. Boiss. No. 1, p. 111, non *A. glandulifera*, S. Wats. in Proc. Am. Acad. xxv. 147 (1890).

South Africa. Transvaal: Waterberg Dist., Potgietersrust, *Burtt-Davy;* Pietersburg Dist., Leydsdorp and Smits Drift Valley, *Burtt-Davy;* Swaziland, near Bremersdorp, *Burtt-Davy*. Ngamiland: Kwebe Hills, 900 m., bush 5–6 ft., fls. yellow, Feb.-Aug., frt. Sep. *Mrs. E. J. Lugard* (type). S.W. Protectorate: bush 8–15 ft. high, common on flats, plateaus, river banks and

dry river beds; Gurmaris, *Pearson* 9256; Holoog, *Pearson* 9814. Namseb, *Pearson* 9335. Bull's Mouth Pass, *Pearson* 8945.

6. **Vahlia capensis,** *Thunb.*, var. **latifolia,** *Burtt-Davy* [Saxifragaceae-Saxifrageae]; a forma typica foliis multo latioribus et pedunculis longioribus differt.

Herba perennis, viscido-puberula. *Folia* oblanceolata, acuta, 1·8–2·5 cm. longa, 3 mm. lata. *Pedunculi* 3–6 mm. longi ex plurimorum foliorum superiorum axillis orti, floribus 1 vel 2, pedicellis brevibus. *Petala* lata, conspicua, 4 mm. longa, flava.

South Africa. Transvaal: Vereeniging Dist.; Uitgevallen 197, about 1480 m., on red quartzite soil, *Burtt-Davy* 15082 *in herb. Bolus.*

7. **Salacia** (?) **transvaalensis**, *Burtt-Davy* [Hippocrateaceae]; frutex habitu folioque *Pterocelastri echinati*, N.E.Br., sed staminibus 3.

Frutex ramosus, glaber, ramulis brevibus rigidis. *Foliorum* petioli 3–4 mm. longi; laminae oblanceolatae vel obovatae, obtusatae vel acutiusculae, 2·4–2·7 cm. longae, 0·8–1·2 cm. latae. *Pedunculi* 1 cm. longi, in axillis foliorum superioribus, multiflori; pedicelli ad 4 mm. longi. *Petala* corollae circiter 3 mm. longa. *Stamina* 3.

South Africa. Transvaal: Lydenburg Dist.; Sabie-hoek forest, January 1906, *Burtt-Davy* 1699.

The habit is unlike that of any other *Salacia* known to me, fruit is needed in order to determine its precise affinity.

8. **Lannea Kirkii,** *Burtt-Davy* [Anacardiaceae-Anacardieae]; *L. Stuhlmanni*, Engl., affinis, foliolis longioribus angustioribusque, pedunculis et pedicellis stellato-pubescentibus, sepalis ciliatis differt.

Arbor parva. *Folia* plerumque 2-juga, 12·5–23 cm. longa, petiolis et foliolis subtus (praecipue in costis et axillis nervorum) sparse stellato-tomentosis supra glabris; petioli 5–6·5 cm. longi; foliola ovata vel oblonga, obtuse acuminata, 5–9 cm. longa, 3–4·3 cm. lata; petiolulus folioli terminalis 1·3–2·6 cm. longus; foliola lateralia subsessilia, 2·6–4·7 cm. distantia. *Racemi* vel *paniculae* ex axillis foliorum orti; pedunculi 6·3–7·6 cm. longi; pedicelli 3 mm. longi. *Fructus* (immaturi) 0·9–1·2 cm. longi, 6 mm. lati.

South Africa. Transvaal: Zoutpansberg District; Tsama River, a tributary of the Klein Letaba, just north of the Tropic, in young fruit, March 31, 1908, *S. Matthewman in T. D. A. Herb.* 4321 and *Herb. Bolus.* (type). S. Rhodesia: Sabi River, at about 300 m., *Swynnerton* 1205 (Chinado name "Mugan 'enkomo" = Cow "muganu"). Port. E. Africa: Gazaland; Lower Buzi River, 120 m., *Swynnerton* 1035; Zambesia: Shupanga, Lower Zambesi, Jan. 10, 1863, *Dr. Kirk in herb. Kew.*

9. **Rhus Gueinzii,** *Sond.*, var. **brevifoliolata,** *Burtt-Davy* [Anacardiaceae-Anacardieae]; formae typicae affinis sed foliolis

minoribus inaequaliter serratis, terminali circiter 3·8 cm. longo et 0·8–1 cm. lato, differt.

South Africa. Transvaal: Waterberg Dist.; farm Rondebosch near Potgietersrust, *Burtt-Davy* 2175 *in herb. Bolus*.

10. **Ficus Bizanae,** *Hutchinson* et *Burtt-Davy* [Moraceae-Artocarpeae]; affinis *F. politae*, Vahl, sed foliis sensim et breviter acuminatis basi cuneatis vel subrotundatis, pedunculis robustis, receptaculis oblongo-ellipsoideis, ostiolo conspicue mamillato differt.

Arbor magna; ramuli hornotini laxe foliati, sicco brunneo-purpurascentes, glabri. *Folia* elliptica vel oblongo-elliptica, basi cuneata vel subrotundata, apice breviter et obtuse acuminata, 8–15 cm. longa, 3·5–7·5 cm. lata, integra, chartacea, glabra, infra laxe reticulata, basi trinervia; costa supra leviter impressa, infra prominens, basi circiter 2 mm. lata; nervi laterales utrinsecus 5–7, a costa sub angulo 45° abeuntes, intra marginem conjuncti, infra prominentes; petioli graciles, 2·5–6 cm. longi, glabri; stipulae mox caducae, acute triangulares, 4·5 mm. longae, glabrae, nitidae. *Receptacula* fasciculata, in ramulos abbreviatos brevissimos ex trunco et ramis principibus ortos disposita, pedunculata, oblongo-ellipsoidea, basi breviter et abrupte stipitata, apice late et prominenter umbonata, circiter 3·5 cm. longa et 2·5 cm. diametro, maculis magnis notata, minute rufescenti-puberula; pedunculi demum recurvati, 1·5 cm. longi, puberuli. *Bracteae* basales 2, late ovatae, coriaceae, persistentes. *Ostiolum* conspicue elevatum, bilabiatum; bracteolae omnes in receptacula descendentes. *Achenia* ellipsoideo-globosa, nitida.

South Africa. Pondoland: Bizana district; rocky banks of the Umtamvoona River, overhanging the water, *J. Burtt-Davy* 15291.

This is a very distinct fig allied to *F. polita*, Vahl, a species widely spread in Tropical Africa. It belongs to the section *Fasciculatae*, characterised by the figs being borne on short arrested branchlets arising from the trunk or main branches remote from the leaves. When the genus *Ficus* was worked out for the Flora Capensis only two species of this section, *F. sansibarica* and *F. polita*, were known from South Africa, the one now described being a third of this otherwise almost exclusively Tropical Africa group.

IV.—NEW ORCHIDS: DECADES XLVIII.–XLIX.

The novelties described in Decades 48–49 were (with a single exception) collected by Sir Everard F. im Thurn, K.C.M.G., when Governor of Fiji and High Commissioner of the Western Pacific. The majority are natives of the Fiji group, and chiefly of the Island of Viti Levu, but the collection contains plants obtained in the New Hebrides and Solomon Islands.

471. **Microstylis Imthurnii,** *Rolfe;* inter species Vitienses pedicellis longis et gracilibus distincta.

Caulis erectus, brevis, 4–5-foliatus. *Folia* breviter petiolata, late elliptico-lanceolata, breviter acuminata 5-nervia, 7–12 cm. longa, 2·5–4 cm. lata. *Scapus* erectus, circiter 20 cm. longus, multiflorus. *Bracteae* reflexae, oblongo-lineares, acuminatae, 4–5 mm. longae. *Pedicelli* 0·8–1 cm. longi. *Sepalum* posticum ovato-oblongum, obtusum, concavum, 5 mm. longum; sepala lateralia late obovato-oblonga, obtusa, subconcava, 3 mm. longa. *Petala* falcato-linearia, obtusa, 5 mm. longa. *Labellum* circuitu reniformi-orbiculatum, 4·5–5·5 mm. diametro; lobus intermedius late obovatus, truncatus et minute bicuspidatus, lobi laterales ample auriculati et obtusi; discus 5-nervius. *Columna* lata. dentibus minutis.

Fiji. Navai: foot of Mt. Victoria, 850 m., March 28, 1906, *im Thurn* 208.

Flowers vanilla-scented.

472. **Microstylis radicicola,** *Rolfe;* habitu *M. platychilae*, Reichb. f., similis, sed labello ample trilobo differt.

Pseudobulbi ovoideo-oblongi, 3–5 cm. longi, vaginis membranaceis obtecti, 3-folii. *Folia* ovata vel elliptico-ovata, acuta v. breviter acuminata, 7-nervia, 9–14 cm. longa, 3·5–5 cm. lata. *Scapi* erecti, 15–25 cm. longi; racemi 5–8 cm. longi, multiflori. *Bracteae* reflexae, lineares, acuminatae, circiter 5 mm. longae. *Pedicelli* circiter 4 mm. longi. *Sepalum* posticum elliptico-oblongum, obtusum, 6 mm. longum; sepala lateralia falcato-obovata, obtusa, 4 mm. longa. *Petala* oblongo-linearia, obtusa, 8 mm. longa. *Labellum* late reniforme, trilobum, 1·3 cm. latum; lobus intermedius late obovatus, truncatus, denticulatus, 0·8–0·9 cm. latus; lobi laterales obovati, 0·5 cm. longi. *Columna* lata.

Fiji. Nandarivatu, on mossy tree roots above ground in shady forest, Feb. 1, 1906, *im Thurn* 64.

This somewhat resembles *M. platychila*, Reichb. f., in habit, but the stems are shorter and more swollen at the base, and the flowers do not agree in structure.

473. **Microstylis latisepala,** *Rolfe;* a *M. Schlechteri*, Rolfe (*M. vitiensis*, Schlechter, non Rolfe) foliis multo majoribus et labello obscure trilobo differt.

Caulis subelongatus, 7–9-foliatus. *Folia* petiolata, elliptico-lanceolata, breviter acuminata, 5-nervosa, 10–15 cm. longa, 3–5 cm. lata; petiolus 4–7 cm. longus, basi ample vaginatus. *Scapus* subelongatus, 10–15 cm. longus, multiflorus. *Bracteae* reflexae, lineares, acuminatae, 0·8–1·2 cm. longae. *Pedicelli* 4–5 mm. longi. *Sepala* elliptico-ovata, 4 mm. longa, apice reflexa et obtusa. *Petala* oblonga, obtusa, 3 mm. longa. *Labellum* circuitu orbiculare, 4–5 mm. diametro, basi late et obtuse auriculata, apice obscure trilobo. *Columna* lata, dentibus oblongis.

Fiji. Navai, March 28, 1906, *im Thurn* 209.

A much larger plant than *M. Schlechteri*, Rolfe (*M. vitiensis*, Schlechter, nec Rolfe),but, judging from the description, approaching it in floral structure. The leaf of *M. latisepala* is said to be purplish, and the flower purple.

474. **Microstylis Everardii,** *Rolfe;* inter species Vitienses labello ample sagittato-auriculato distinctis.

Caulis brevis, 4–5-foliatus. *Folia* breviter petiolata, elliptico-ovata, breviter acuminata, 3–6 cm. longa, 1·8–3 cm. lata, 5-nervia; petioli basi laxe vaginati. *Scapi* circiter 7 cm. longi, pauciflori. *Bracteae* patentes vel reflexae, lineares, 2–3 mm. longae. *Pedicelli* circiter 5 mm. longi. *Sepalum* posticum elliptico-oblongum, obtusum, 6 mm. longum; sepala lateralia falcato-ovata, subobtusa, 2·5 cm. longa. *Petala* lineari-oblonga, obtusa, 4 mm. lata. *Labellum* circuitu elliptico-orbiculare, 3·5 mm. diametro; lobus intermedius late oblongus, bidentatus, lobi laterales ample sagittato-auriculati, oblongi, obtusi. *Columna* lata, dentibus minutis.

Fiji. Navai, March, 1906, *im Thurn*, s.n.

A rather small, lax-flowered species.

475. **Microstylis longifolia,** *Rolfe;* inter species Vitienses foliis angustis et attenuatis facile distinguenda.

Caules subelongati, 5–6-folii. *Folia* lineari-lanceolata, acuminata, 6–12 cm. longa, 0·5–0·8 cm. lata, basi vaginis ovato-lanceolatis dilatata. *Scapi* 10–15 cm. longi, laxiflori. *Bracteae* patentes vel subreflexae, lanceolatae, acuminatae, 4–6 mm. longae. *Pedicelli* 5–6 mm. longi. *Sepala* ovata, subobtusa, concava, 3 mm. longa. *Petala* lineari-lanceolata, subacuta, 4–5 mm. longa. *Labellum* circuitu orbiculare, trilobum, circiter 4 mm. latum; lobi laterales late auriculati, lobus intermedius suborbicularis, profunde fimbriatus. *Columna* lata, brevis, dentata.

Fiji. Common everywhere in Fiji in the forks of the Ivi (Inocarpus, &c.) trees, Jan. 1878, *J. Horne*.

A fruiting specimen collected by Seemann (n. 616) at Motariki is quite similar in habit, but has longer scapes and leaves and may be different. Reichenbach labelled it "*Liparis* non-determinable," but it has the short broad column of *Microstylis*.

476. **Liparis** (§ **Coriifolii**) **vitiensis,** *Rolfe;* a *L. longipede*, Lindl., racemis multo laxioribus differt.

Pseudobulbi oblongi, 2–3 cm. longi, diphylli, basi vaginis ovato-lanceolatis obtecti. *Folia* lanceolata, acuta, 5-nervia, subcoriacea, 8–16 cm. longa, 1–1·5 cm. lata. *Scapi* erecti, 14–20 cm. longi, laxe multiflori. *Bracteae* lanceolato-lineares, acutae, 4–6 mm. longae. *Pedicelli* 0·7–1·0 cm. longi. *Sepala* recurva, oblongo-linearia, obtusa, subacuta, circiter 3·5 mm. longa. *Petala* recurva, linearia, acuta, 3·5 cm. longa. *Labellum* recurvum, obovato-oblongum, obtusum, circiter 3·5 cm. longum; discus ecallosus. *Columna* clavata, curvata, 2 mm. longa.

Fiji. Vesari Swamp, in forest by side of Suva Navua road, July 28, 1907, *im Thurn* 370.

477. **Dendrobium (Grastidium) Everardii,** *Rolfe;* affine *D. dactylodi,* Reichb. f., sed floribus duplo brevioribus facile distinguendum.

Caules erecti, subgraciles, 20–30 cm. longi, distichophylli. *Folia* oblongo-lanceolata, obtusa, coriacea, 3·5–7 cm. longa, 0·8–1·5 cm. lata, vaginis striatis. *Inflorescentia* axillaris, brevissima, biflora vel uniflora, basi vaginis late oblongis obtusis, striatulis 0·5 cm. longis obtecta. *Bracteae* minutae. *Pedicelli* 1 cm. longi. *Sepalum* posticum incurvum, lineari-lanceolatum, acutum, 1·5 cm. longum; sepala lateralia triangulari-oblonga, acuta, 1·3–1·5 cm. longa. *Petala* incurva, linearia, acuta, 1·5 cm. longa. *Labellum* unguiculatum, trilobum, 6–7 mm. longum; lobi laterales lati, subacuti, lobus intermedius spiraliter recurvus, acutus, margine undulato-crispus. *Columna* lata, 4 mm. longa.

Fiji. Nandrau, Dec. 5, 1906, *im Thurn* 316. Nandarivatu, Dec. 7, 1906, *im Thurn* 326.

Closely resembling the Samoan *D. dactylodes,* Reichb. f., in general appearance, but differing markedly in the broad and far shorter floral segments. Flowers yellow.

478. **Dendrobium (Grastidium) malaitense.** *Rolfe; D. salaccensi,* Lindl., affine, sed floribus multo majoribus differt.

Caules subgraciles, elongati, 3–4 mm. lati, distichophylli. *Folia* subpatentia, elongato-ligulata, inaequaliter bidentata et obtusa, 9–17 cm. longa, 0·8–1·1 cm. lata, vaginis minute striatulis et rugulosis. *Racemi* biflori, basi spathis semiorbicularibus brevibus obtecti. *Pedicelli* 0·7–0·8 cm. longi. *Sepalum* posticum elliptico-oblongum, subobtusum, circiter 1·5 cm. longum, 0·5–0·6 cm. latum; sepala lateralia oblonga, subobtusa, 1·5 cm. longa, 0·6 cm. lata, basi in mentum breve obtusum extensa. *Petala* elliptica, subobtusa, 1·5 cm. longa, 0·7 cm. lata. *Labellum* pandurato-trilobum, 1 cm. longum; lobi laterales suborbiculares, 3 mm. longi, lobus intermedius ovato-oblongus, subacutus, 3·5–4 mm. latus; discus minute carinatus. *Columna* lata, 3·5 mm. longa.

Solomon Islands. Langi Langi, Malaita, Aug. 1905, *im Thurn,* 363. Flowered at Suva, Aug. 1907. Flowers white, ephemeral and very easily detached.

Near *D. salaccense,* Blume, and *D. alagense,* Ames, but with larger flowers.

479. **Dendrobium (Rhizobium) calamiforme,** *Rolfe;* a *D. crispato,* Swartz, foliis longioribus et floribus multo majoribus differt.

Caulis ramosus, patenti-pendulus, gracilis, apice monophyllus. *Folia* teretia, acuta, 7–20 cm. longa, 3–5 mm. lata. *Racemi* graciles, 7–15 cm. longi, laxiflori. *Bracteae* subobsoletae.

Pedicelli 1·5 cm. longi. *Sepalum* posticum lineare, acutum, 1·5 cm. longum; sepala lateralia posticum similia, basi in mentum oblongum obtusum 0·8–1 cm. longum extensa. *Petala* anguste linearia, acuta, 1·5 cm. longa. *Labellum* trilobum, 1·5 cm. longum; lobi laterales oblongi, obtusi, 0·8 cm. longi, lobus intermedius recurvus, lineari-lanceolatus, acuminatus, crispo-undulatus, 0·7 cm. longus. *Columna* lata, 2 mm. longa. *D. crispatum*, Seem. Syn. Pl. Vit., p. 12; Reichb. f., in Seem. Fl. Vit., p. 303 (non Swartz); Kraenzl. in Engl. Pflanzenr. Orch. Dendrob. i., p. 293, ex parte).

Fiji. *Seemann*, 579; *Horne*, 1085. Nandarivatu, *im Thurn* 376.

New Hebrides, Rason's Island, Vila Harbour, Dec. 26, 1906, *im Thurn* 328.

Allied to the Tahitian *D. crispatum*, Swartz, with which it has been confused, but readily distinguished by its much longer leaves and the flowers double the size. Horne remarks: "Common at some places on trees overhanging the sea and salt water marshes. Flowers, yellow." Seemann originally identified the plant with the Australian *D. calamiforme*, Lodd., but as the latter is synonymous with *D. teretifolium*, R. Br., it leaves the very characteristic specific name free for the present plant. The later identification with the Tahitian *D. crispatum*, Swartz, is also erroneous.

480. **Dendrobium** (§ **Speciosa**) **vitiense,** *Rolfe; D. agrostophyllo*, F. Muell., simile, sed floribus multo minoribus differt.

Caules subgraciles, erecti, subcylindrici, 12–14 cm. longi, supra nodos leviter constricti, distichophylli. *Folia* oblongo-lanceolata, breviter et inaequaliter biloba, subcoriacea, 4–5 cm. longa, 0·6–1 cm. lata. *Racemi* axillares, subgraciles, 2·5–4 cm. longi, laxiflori. *Bracteae* late ovatae, subobtusae, 1 mm. longae. *Pedicelli* 0·5–0·8 cm. longi. *Sepalum* posticum ovatum, obtusum, 4 mm. longum; sepala lateralia late ovata, obtusa, 5 mm. longa, basi in saccum breven obtusum extensa. *Petala* elliptica, obtusa, 4 mm. longa. *Labellum* latum, trilobum, 4 mm. longum; lobi laterales breves, obtusi, lobus intermedius reniformis, sub-emarginatus, 2·5–3 mm. latus; discus obtuse bicarinatus. *Columna* lata, 1 mm. longa.

Fiji. Nandrau, in mountains of Viti Levu, 1500 m., Dec. 5, 1906, *im Thurn* 317.

This species has much the general habit of *D. agrostophyllum*, F. Muell., to which it is apparently allied, but has far smaller flowers. The latter are described as purple.

—NOTES ON SPECIES OF COLLETOTRICHUM AND PHOMA IN UGANDA.

W. Small.

A.—Colletotrichum on Coffee and Cacao.

Colletotrichum coffeanum, *Noack*, **and Phoma** sp. **on coffee.**—A species of *Colletotrichum* of economic importance was first recorded in Uganda about the year 1908 when Dawe sent to Kew coffee* material showing leaf-blotching and gradual withering of the branches. Massee had proposed the name of *Colletotrichum coffeae* for a fungus found on the affected leaves and twigs, but his description was never published. *C. coffeae* is therefore a *nomen nudum*, and it is more than likely that Massee's *C. coffeae* was *Colletotrichum coffeanum*, Noack, which was named and described in 1901 from material from Brazil.† *Colletotrichum coffeanum* occurs so regularly on Uganda coffee in association with what has been termed "dieback," that we are justified in concluding that it was present in the country in 1908, even although the details of the 1908 disease are so meagre that there can be no certainty that its effects, particularly the withering of branches ascribed to it, were similar to present-day dieback. This fungus has a wide distribution. It has been reported from South India, Brazil, Costa Rica and Porto Rico, while *Gloeosporium coffeanum*, Del., which is probably the same fungus, despite the lack of the setae usually found on acervuli of *Colletotrichum*, has been found in Réunion, Madagascar and Java. Another species of the same genus, *C. incarnatum*, Zimm., which may be, and probably is, identical with *C. coffeanum*, has been known for several years on coffee leaves in what was German East Africa.‡ *C. incarnatum* has also been given as the cause of a dieback of *Coffea robusta* in Ceylon,§ but, so far as the writer is aware, no experiments have been undertaken to test the assertion.

In 1913, a species of *Colletotrichum*, subsequently identified as *C. coffeanum*, Noack, was found by the writer on coffee branches‖ which were dying back, but its presence was not of regular occurrence. In later years, however, leaf-blotching became more prominent at intervals, and *Colletotrichum* was found to be associated more regularly with that affection and with dieback twigs. It was also found to attack the berries, and there seems no room to doubt that it was becoming increasingly plentiful in its occurrence on the various parts of the coffee tree. Quite naturally there was then a tendency to ascribe all coffee dieback to the work of *Colletotrichum*. But, as was pointed

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* *Coffea arabica.*
† Zeitschr. f. Pflanzenkr. II, 1901, p. 196.
‡ Der Pflanzer, 1913, 9, 76.
§ Tropical Agriculturist, 45, 156, Sept., 1915.
‖ Annual Report, Dept. Agric. Uganda, 1913–14, p. 60.

out in 1915,* other fungi were found on dieback branches, viz., *Periconia byssoides*, Pers., *Phoma* sp., *Fusarium coffeicola*, P. Henn., a second species of *Fusarium*, and *Tubercularia* sp. It was also emphasised that various physiological factors were involved in the production of dieback. The *Phoma* and *Tubercularia* were at that time scarcer than the other fungi, and none of the forms was constant in its presence on dieback branches. Moreover, the mode of parasitism seemed unusual. The *Periconia* and *Tubercularia* were always regarded as saprophytes, and recent work† has shown that both the species of *Fusarium* should be placed in the same category. Other forms found at times on dieback coffee branches are the perithecia of *Capnodium brasiliensis*, Putt., the fungus of sooty mould, and of a species of *Glomerella*, the complete stage of *Colletotrichum coffeanum*, which is found after the lapse of three or more months on twigs kept in the damp, an ascomycete which may be the ascigerous stage of the *Phoma*, and a *Coniothecium* which forms a stage in the life-history of the *Phoma*. The supposed ascigerous stage of the *Phoma* is very rare. At the present day, the preponderance of numbers is at times in favour of *Colletotrichum*, at others in favour of *Phoma*.

Histological examination of certain dieback coffee branches discloses the presence of mycelium in the tissues of wood and cortex. This mycelium is septate, branched, and pale brown or hyaline in colour, and it may be nodulose. It penetrates transverse cell-walls, disorganises longitudinal cell-walls, and so works its way between adjacent cells as to bring about splitting and cracking. It impregnates the cortical tissues more fully than those of the wood, and it consumes the cell-contents, for none are visible where invading hyphae are present. This mycelium can be shown to belong to *Phoma* or *Colletotrichum*; the nodulose mycelium would appear to be that of *Phoma*.

In the elucidation of the parts played by the different fungi associated with coffee dieback in Uganda, it was found necessary to grow in pure culture *Colletotrichum*, *Phoma*, *Fusarium coffeicola* and *Fusarium* sp., these fungi being more consistent in their presence on dieback branches and seeming to be more implicated in the production of dieback than any of the other forms mentioned. Two and a half per cent. agar tubes and plates were used, and a nutrient base was supplied by sugar-cane, prune, coffee-leaf, or cacao-pod extract or decoction. The fungi were also grown on sterilised coffee-wood blocks and coffee leaves. Inoculations of the various media were made by the direct transfer of spores on the point of a sterile needle, or by suspending the spores in a drop of sterile distilled water and using a platinum loop.

Colletotrichum coffeanum in pure culture.—Conidia of *Colletotrichum* germinate readily at laboratory temperature in a few

* Annual Report, Dept. Agric. Uganda, 1914–15, p. 61.

† Small: Dieback of *Coffea arabica* in Uganda: Circ. No. 4, Dept. Agric. 1920.

hours in hanging-drops of sugar-cane extract, prune decoction, or distilled water. During germination they become septate, and extrude hyaline, septate, finely-granular germ-tubes of a thickness of 3 μ. The germ-tubes may branch quite early. After twenty-four hours, numerous dark-brown appressoria are formed; in a further eighteen hours, the hanging-drop appears to the eye as a mass of white hyphae. In solid media, the fungus grows rapidly. Aerial white flocculent mycelium appears overnight, and conidial formation takes place in three or four days. On sterilised blocks of coffee-wood in Roux tubes results are similar, and subsequent examination shows the hyphae of the fungus to have penetrated the blocks. Setal formation takes place comparatively seldom. It may depend on the amount of moisture present or on the age of the acervulus, but modifications in the moisture content of the Roux tubes did not seem to influence the appearance or non-appearance of the setae. On the acervuli of *Colletotrichum* on twigs in a damp chamber, setae frequently do not develop at all, or they may appear late when conidial production is slackening down. They may be, for example, only half the length given by Zimmerman for the setae of *Colletotrichum incarnatum** five days after the conidia are ready to, and do, germinate. On sterilised coffee leaves, the fungus produces no setae. This is the case also in nature when the fungus attacks the leaves. On the berries, again, setae may or may not occur. The presence or absence of setae is thus an inconstant character, and, though it has been usual to refer setae-less acervuli to the genus *Gloeosporium*, the writer's opinion is that the acervuli and conidia of *Gloeosporium* on the leaves (*G. coffeanum*, Del.), and the *Colletotrichum* on the stems are indistinguishable and that the two species may well be the same. Cultures were prepared from stem, leaf, and berry material, *i.e.*, from both *Colletotrichum* and *Gloeosporium* spores, and no differences could be detected in the growth of the various mycelia or in conidial formation. It is generally agreed that the separating line between *Colletotrichum* and *Gloeosporium* is a narrow one, and that the basis of distinction is artificial, and it would appear that the presence or absence of setae is governed more by physiological conditions than by a hard-and-fast morphological rule.

Inoculations with Colletotrichum coffeanum.—Material consisting of conidia and mycelium from the cultures was used in inoculation experiments in the study of coffee dieback. Inoculations were made (1) by wounds and punctures on twigs at the nodes, in the course of the internodes, and at the tender growing point of the stem, and (2) by placing the inoculum on both surfaces of leaves, on the unwounded bark of nodes and internodes of twigs, and upon the apical growing point. Young healthy plants were used for the most part, but fresh healthy twigs were also employed. The latter were kept in cylinders of

* Noack gave no measurements of the setae of *C. coffeanum*.

Sach's water-culture solution alternated at intervals of seven or ten days with rain water. Controls were kept in all experiments, and the viability of the inoculum conidia was tested in hanging-drops. It was found that the leaf-inoculations were far more successful than any of the others. In fact, eleven out of twelve leaf-inoculations gave positive results, while only one out of thirty-two of the others was successful. At a later date, two further series of leaf-inoculations gave 100 per cent. positive results. Older tougher leaves were as susceptible as younger leaves, and the upper surfaces as the under. The first signs of leaf-infection were noticeable after fifteen or sixteen days, and the mycelium of the fungus was traceable through the leaf-petioles into the stems. Later, numerous acervuli developed on the twigs bearing the inoculated leaves and on the leaves themselves after about ten days in a damp chamber. The one successful stem inoculation was made through a punctured wound in the growing point. Twelve days after inoculation, the stem apex began to blacken. This was followed by the collapse of the apical pair of leaves and by the extension downwards of the discoloration. *Colletotrichum* was afterwards recovered from the affected stem.

A full discussion of the significance of *Colletotrichum* in connection with coffee dieback need not be initiated here, for details are to be found in the publication referred to.* Suffice it to say that the infective conidia of *Colletotrichum coffeanum* have been shown to be common in the atmosphere and that they have been proved capable of invading the coffee tree, and to note that the conclusion has been arrived at that *Colletotrichum coffeanum* is not an aggressive parasite of the coffee tree, and that it need not bring on attacks of dieback unless the conditions for its advance are rendered favourable. That this is so has been proved in practice. Unfortunately a survey of the history of coffee in Uganda shows that the crop was often not as able as it might have been to resist attacks of *Colletotrichum*. The older trees were seriously weakened by leaf disease (*Hemileia vastatrix*, B. and Br.) at a time when they were in full bearing of what was, in many cases, their first full crop, by the effects of overbearing, by neglect of cultivation and pruning, by the lack of attention to seed-selection and the necessity for rearing and planting out only the best plants, by hurried planting, and by successive serious attacks of various insect pests. At the present time, the oldest coffee in many cases seems to be still suffering from the leaf-disease and overbearing of 1913–14 and to be subject to dieback, despite the increased attention that has been given to it, while younger coffee which has been brought up, as it were, in the light of the experience gained from a study of the behaviour of the older trees, is found to suffer from true dieback to the extent of only a branch here and there. The older larger-scale

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* Small: Dieback of *Coffea arabica* in Uganda. Circ. No. 4, Dept. of Agric. 1920.

dieback took the form of the complete desiccation of all the main branches situated between the oldest basal mass of branches and the apical crown of young non-bearing shoots of what was as yet an un-"topped" tree. After "topping" and the resulting cessation of upward growth, the desiccated branches were to be found also at the top of the tree, for the apical branches had by then come into bearing. It might be remarked at this point, in leaving this part of the subject, that *desiccation of coffee branches* or even *coffee-tree desiccation* would be a more correct and more scientific name for the condition known as *dieback*, and that, when only one or a few branches are affected, the term *anthracnose* might be used. Local use and custom are such, however, that it is desirable to retain the name of *dieback*, and to distinguish in practice between large-scale and small-scale varieties of it.

Colletotrichum and Glomerella: cross-inoculations.—After from fifteen to twenty days, certain of the pure cultures of *Colletotrichum coffeanum* will show caespitose perithecia of a species of *Glomerella*. These succeed the acervulus stage. This *Glomerella* has been identified at Kew as *C. cingulata*, S. and v. S., and it has been obtained in other ways. As already mentioned, it may succeed the acervuli of *Colletotrichum coffeanum* on coffee twigs after the lapse of a few months.

In the course of investigation, it was found that there were practically no morphological differences between *C. coffeanum* on coffee and the *Colletotrichum* occurring on rotted and hardened cacao pods. The latter from hardened pod-shells was identified at Kew as *Colletotrichum theobromicolum*, Del., but what appeared to be exactly the same form on rotted parts of pods had been regarded by the writer as *Colletotrichum incarnatum*, Zimm.* The chief point of distinction between these two species seems to be that the conidia of *C. incarnatum* stain blue with iodine while those of *C. theobromicolum* do not react in that way. The conidia of *Colletotrichum* from cacao pods have stained only yellow when tested, but, again, conidia from a specimen of *Colletotrichum incarnatum* on *Coffea robusta* kindly sent me from Ceylon by Mr. Petch, did not stain blue when tested. The morphological differences between *coffeanum*, *theobromicolum*, and *incarnatum* seem to be too slight to justify their separation into distinct species. Perhaps the foregoing remark should be extended to include other two cacao species, viz., *C. luxificum*, van Hall and Drost, and *C. Cradwickii*, Ban. *Colletotrichum theobromae*, Appel and Strunk, described on cacao pods from Victoria, seems to stand apart inasmuch as its conidia are distinctly smaller than those of the fungi mentioned.

Further evidence of close relationship between *coffeanum*, *incarnatum* and *theobromicolum* was obtained as follows: Conidia of *Colletotrichum coffeanum* in pure culture (derived from coffee berries) were inserted under sterile conditions in wounds made

* Cf. Petch, Circs. & Agric. Journal, R.B.G., Ceylon, 1910, v. 13, p. 147.

in cacao pods by cutting and raising pieces of tissue. After inoculation, the raised tissues were replaced, and the parts were kept moist with sterile cotton-wool soaked in sterile distilled water. After four days, mycelium appeared aerially around the edges of all the inoculation cuts (sixteen in number), and, after ten days, conidia of *Colletotrichum* were present in numbers on both sides of the cuts. After a further ten days, caespitose perithecia of *Glomerella cingulata*, S. and v. S., developed on the site of the *Colletotrichum* acervuli. Control pods, wounded as above, did not show any fungus growth. Similarly, cacao twigs were inoculated with *Colletotrichum* conidia in wounds. In their case, growth of the inoculum was slower than in the case of the pods, but the results were the same. Conidia were also placed on unwounded surfaces of pods and twigs, but, although they germinated freely and produced numerous appressoria, no penetration of the unbroken surfaces resulted. *Colletotrichum coffeanum* was thus proved to be capable of vigorous growth on cacao material. Its effects were indistinguishable from the usual pod-rot of Uganda, and the *Colletotrichum* and *Glomerella* on the pods and twigs were morphologically indistinguishable, the former from *coffeanum* or *incarnatum*, the latter from *Glomerella* on coffee twigs. Conversely, *Glomerella* ascospores from a cacao-pod when sown in prune-agar plates, gave an aerial mycelial growth in forty-eight hours, which was succeeded in five days by conidial formation, the conidia being identical with those of *Colletotrichum coffeanum*, and the same ascospores when inoculated direct into wounds in cacao-pods gave fifty per cent. positive results with the production of *Colletotrichum* conidia in abundance. Ascospores placed on pods germinated but did not penetrate the unbroken skin.

Further work consisted of the transfer of *Colletotrichum* conidia direct from rotted cacao-pods found on trees to agar plates and tubes, and the employment of the resulting cultures to inoculate coffee leaves. The behaviour of the fungus in these cultures was exactly similar to that of the coffee *Colletotrichum*. Sixteen inoculations were performed with *Colletotrichum* conidia, and, in every case, positive results followed. An asetose *Colletotrichum*, indistinguishable in other respects from *Colletotrichum coffeanum*, was recovered from all. Controls remained healthy. Thus the cacaó-pod *Colletotrichum*, whether *incarnatum* or *theobromicolum*, was shown capable of infecting coffee. The conclusion to be drawn from the cross-inoculation results and cultural evidences is that *C. coffeanum*, and either *C. incarnatum* or *C. theobromicolum*, or both, are, if not the same species, closely related forms which vary under natural conditions. If distinctions are to be preserved between them, they would seem to be of a physiological rather than a morphological nature, and to be based on the existence of physiological varieties within the morphological species. The conclusion from the succession of forms mentioned above, viz., *Colletotrichum* conidia and *Glome-*

rella perithecia, and vice-versâ, is that the former is the conidial stage of the latter.* It might be mentioned here that the few attempts made to infect *Coffea robusta* and *Coffea excelsa* with conidia from cacao *Colletotrichum* have been unsuccessful.

B.—Colletotrichum on Tea, Cotton, and other Plants.

Colletotrichum on Tea.—*Colletotrichum camelliae*, Mass., the fungus causing Brown Blight of tea, is to be found in Uganda on leaves of all ages. The *Glomerella* stage has not yet been encountered in nature, and the fungus has not been studied in pure culture.† The small areas of tea in the country are of the nature of experimental plots rather than commercial enterprises, and little attention has been given to them. An opportunity, however, was taken recently to inoculate some young tea plants with *Colletotrichum* conidia taken from cultures derived from both coffee and cacao material. Conidia were placed on the apical bud of the stem, and introduced into the stem by punctured wounds, were placed on nodes and internodes of stems and also brought into contact with the nodal and internodal cortical tissues by means of wounds, and were placed on both surfaces of leaves. During a necessary absence of the writer from headquarters, the two series of experimental plants became mixed with the control plants. Results were thus rendered valueless; they were, however, very few. It was only in the case of three plants out of twelve which were inoculated by internodal or nodal wounds that shrivelling of the young leaves and blackening of the inoculated stems were followed by the recovery of *Colletotrichum in vitro*. The conidia of the recovered fungus measured only 10–13 × 4 μ and there were no setae. The leaf-inoculations seemed more successful, but could not be taken into account. It is thus impossible to assert that the tea *Colletotrichum* stands in the same relationship to *Colletotrichum incarnatum* or *C. coffeanum* as *C. incarnatum* does to *C. coffeanum*, but it ought to be noted that, morphologically, *camelliae* is as similar to *coffeanum* as *coffeanum* to *incarnatum*.

Colletotrichum on Garden Plants and Cotton.—Species of *Colletotrichum* have been found on garden plants of *Codiaeum* and *Eranthemum* which were dying back. They are morphologically similar to each other and to *C. coffeanum*, but no cross-inoculation tests have yet been made in order to eludicate their relationships with each other or with the fungus found on coffee.

Anthracnose of cotton-bolls is responsible for a certain amount of yearly loss in the cotton crop of Uganda. The causal fungus is usually confined to the bolls, and it may so penetrate

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* Cf. Dastur. Annals of Appd. Biology, VI. 4, 245, 1920.

† The Brown Blight of tea in Assam, from which Massee's original material came, has been shown by Tunstall (*see* Proceedings of the Second Meeting of Mycological Workers in India, p. 56, Board of Agriculture in India, 1919) to be caused by *G. cingulata*, the perithecial stage having been obtained in cultures.

them as to cause rotting of seed and lint. It also causes malformations and premature bursting and cracking which result in the spoiling of the lint through the entrance of other agents besides the anthracnose fungus. The fungus at work is *Colletotrichum gossypii*, South. Its complete stage, *Glomerella gossypii*, Edg., is to be found only at times, for the conidial condition is much more common than the ascomycete. At the end of the cotton harvest in Uganda, it is compulsory for all growers to remove and burn all the plants, and in this way the ravages of this boll disease are kept within bounds. The old custom among native cotton growers of opening up new land for each sowing season is being departed from, and it is therefore to be expected that boll-anthracnose will increase in severity rather than decrease, especially when the annual burning is carelessly carried out. No data are available as to the resisting powers of the different strains of cotton in the country, but observations made would point to all as equally susceptible.

Gloeosporium spp. **on Bananas and Hevea.**—*Gloeosporium musarum*, Cke. and Mass., is to be found at times on ripe bananas. It causes black spots on the fruit which eventually lead to a complete rot. This fungus would be responsible no doubt for a much greater loss of native food-stuff than it has been hitherto, were it not for the fact that the native cuts and cooks his food bananas while they are still unripe and green. *Gloeosporium albo-rubrum*, Petch., occurs on green shoots of *Hevea*, and causes them to die back. It is in this way responsible for the entry into the tree of *Botryodiplodia theobromae*, Pat., which attacks the older woody branches and often makes necessary severe amputation before its ravages can be stopped. *C. alborubrum* is frequently found in close association with *Phyllosticta ramicola*, Petch.

Other species of *Colletotrichum* (*Gloeosporium*) occur on mangoes, guavas, pomegranates and species of *Citrus*, but they have not yet been investigated.

C.—Phoma spp. on Coffee and Hevea.

Phoma sp. **in pure culture.**—It has already been mentioned that *Phoma* sp. occurring, as it does, frequently on coffee stems was considered to be implicated in the production of dieback of coffee, and was grown in pure culture. The minute black pycnidia of this fungus extrude yellow-red "tendrils" of spores after from ten days to a few months in a damp chamber. The pycnospores germinate readily in coffee-leaf or prune-agar plates and slants at laboratory temperature. Aerial septate mycelium, at first white but becoming dark grey with age, appears in concentric arcs stretching across the surface of the medium, and globular, thick walled conidia of a diameter of 12·5–17·5 μ, when young, hyaline, and when mature, dark-brown or black, appear first. They are cut off terminally from the mycelium,

the cell behind the conidium being slightly bulbous or swollen. These conidia were found to germinate slowly in from six to nine days in hanging-drops of distilled water, and to give rise to secondary thin-walled conidia which germinated readily and produced further thin-walled conidia which in turn pushed forth delicate hyaline germ-tubes. The secondary conidia may themselves become dark in colour, and form, along with the original conidia, a *Coniothecium* stage of the *Phoma*. This *Coniothecium* form has been found on coffee twigs, but never, to date, in the tissues. No further stage in its development has been observed.

Pycnidial formation takes place after the lapse of six weeks. The conidia or pycnospores are continuous, hyaline, though red-yellow in the mass, elongated, up to 5 μ by 1 μ in breadth, and guttulate. The coniodiophores are half the length of the conidia. Pycnospores in nature measure 4·5 μ by 1·5–2 μ, are elongate-ovate, the longer spores being the narrower in proportion and are contained in pycnidia which are 2·5 mm. in diameter, black and carbonaceous. In cultures, the pycnidia are smaller, the largest measuring up to 2 mm. in diameter. No ascigerous stage has been found in any of the cultures though they have been kept for over eight months. Chlamydospores appear before pycnidial formation takes place. They are formed by breaking up of the mycelium, and, while at first irregular in shape and more or less hyaline, they eventually become globular, thick-walled and brown. They measure up to 20 μ in diameter. They germinate in drops of rain-water in from fourteen to twenty days. In an old culture, chlamydospores become so numerous that they can be seen by the naked eye as dots in the course of the mycelium.

On sterilised coffee-wood blocks, *Phoma* grows rapidly. Pycnidia are produced in abundance in twelve days. They measure up to 2 mm. in diameter, and their spores up to 5 $\mu \times 2\,\mu$. The *Coniothecium* is also produced in plenty. Microscopic examination of the blocks showed the mycelium of the *Phoma* penetrating medullary-ray elements and pitted tracheids to a depth of 3 mm. in twelve days.

Inoculations with Phoma sp.: **the part played by the Variegated Bug.**—Inoculation experiments similar in all respects to those performed with *Colletotrichum* on coffee were carried out with material from the *Phoma* cultures. Pycnospores or chlamydospores and mycelium were placed on upper and under surfaces of leaves, on stems at nodes and along internodes, and in nodal and internodal wounds of stems. The total number of inoculations was sixty, and of these only one was successful. In it pycnospores had been placed on the unbroken internodal bark of a branch, the apical leaves of which began to droop after two months. Mycelium was found in the branch tissues near the point of inoculation, and *Phoma* was subsequently recovered.

It is difficult to explain why all the *Phoma* inoculations except one were negative, and to reconcile the apparent difficulty

of inducing infection with the actual presence of the fungus in dieback tissues and its proved powers of penetrating coffee-wood blocks, until one takes up the mycological investigation of the insect pests of coffee. Of these one of the most dangerous is the Variegated Bug (*Antestia orbitalis*, Westw. var. *faceta*. Germ.) which punctures and sucks the juices from twigs, buds, and berries. In the study of the broken and chipped beans which on curing are frequently found inside what appear to be perfectly sound-skinned cherries, it occurred to the writer that the fungus found on such "lights" might possibly be introduced by the Variegated Bug.

This theory was put forward in 1916* when the appearance of the Bug in dangerous numbers coincided in time with the occurrence of the broken beans. Then, as now, pycnidia of the same species of *Phoma* as is found on the branches were invariably found on small "cankers" on the cotyledons. In order to throw light on this supposition, legs and beaks of the Variegated Bug were taken from the insects with sterile forceps, shaken up in prune-agar and sugar-cane agar, and poured into plates. In all the cultures, except one which was productive of bacteria and moulds only, *Phoma* mycelium appeared aerially in forty-eight hours. None of the cultures was pure in the sense that it contained a growth of one species of fungus or bacterium only, for the *Fusarium* sp. was found in sixty per cent., moulds in eighty, and bacteria in twenty per cent. If, as appears probable from these facts, the Bug carries the spores of *Phoma* in or on its beak, that is, in or on the organ it introduces into tender tissues in order to suck, it is to be concluded that this pest is to blame not only for the broken beans but also for the presence of *Phoma* in tissues which it may be incapable of penetrating without the help of an outside agent.

It is somewhat remarkable that *Colletotrichum* was altogether absent from these Variated Bug beak and leg cultures, but this may have been due to the circumstances of the moment. Again, no other pest from among the seventeen scale insects known on Uganda coffee, or the aphids, or other plant bugs (*Lycidocorus mimeticus*, R. and P., and *Piezodorus pallescens*, Germ.) or borers, etc., has been examined on these lines, and there may be no reason why all or any one of these should not carry and introduce into attacked tissues both *Colletotrichum* and *Phoma*. The former *alone* has developed on obviously bug-smitten branches, but it may have been present as a saprophyte, for numerous acervuli of *Colletotrichum* will develop on previously healthy fresh branches when plucked and kept in the damp. Similarly, *Phoma* pycnidia can be found on healthy branches, apparently causing no harm and probably lying in wait, as it were, to initiate a vigorous attack on the weakening of the tree owing to the results of unfavourable conditions such as leaf-disease,

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* Small: Notes on a few Ug. diseases of plants, Ug. Pl. Assn. Yr. Bk. 1916–17, p. 135.

unsuitable climatic conditions, or overbearing. Inoculation results indicate that *Phoma* by itself is by no means an aggressive parasite, and there is, further, no Uganda evidence of such a *Phoma* disease of coffee as that described by Dowson in British East Africa.* The recommendations made with regard to the coffee dieback with which *Colletotrichum* and *Phoma* are implicated consist of measures designed to produce a healthy and resistant tree.

Phoma on Hevea.—The only other species of *Phoma* found on a plant of economic importance is *Phoma heveae*, Petch, which occurs on *Hevea* branches, apparently without causing any harm.

VI.—THE AGRICULTURAL DEPARTMENT, DOMINICA.

A. Keys.

We have received the following interesting account of the development of the Agricultural Department, Dominica, from Mr. A. Keys, the Assistant Curator of the Botanic Gardens, Dominica, who was sent out from Kew in the early summer of 1919 (K.B. 1919, p. 237).

We are glad to be able to publish this useful record, especially as it enables the valuable and devoted labours of Mr. Joseph Jones to be more fully appreciated. Mr. Jones left Kew to take up his appointment as Curator of the Botanic Station, Dominica, in March, 1892.

It may be said in connection with the Agricultural Department of Dominica that, since its humble beginning as a Botanic Station 28 years ago, its progress has been rapid and its functions useful. Further, it has taken into account every important section of agriculture constituting the work of a department worthy of the name; always with due regard to the requirements of this wonderful Island.

In giving a few notes of things "past and present" relative to the Gardens and their surroundings, it will be as well to start with the Botanic Gardens proper which gave birth to the present Agricultural Department.

The Botanic Gardens.

The Botanic Gardens, Dominica, might well be described as a miniature Kew: their object is the same in the sense that they were established to further the interests of agriculture, and their position amongst other gardens of the West Indies is comparable to that of Kew in Europe; but they do not possess a herbarium and cannot boast of glass houses or museums.

The Gardens in Dominica, like most others of their kind can only rank as an "outpost" or a link in the chain of establishments

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* Dowson: A new disease of coffee; Leaflet No. 1, Div. of Mycology, Dept. Agric. B. E. A., October, 1917.

reaching out from Kew to the farthest ends of the Empire, each one of which serves a similar purpose within its own particular sphere. Kew—the "mother" of all the smaller establishments —stands supreme. It occupies a central position, and is suitably equipped for a far wider range of activities, keeping the smaller gardens in touch with one another, and helping them out of such difficulties as establishments on a less pretentious scale are sure to encounter.

Much might be said of the relations which have existed between Kew and the "outposts" since its very beginning, but to most of us the excellent results that have accrued from this intimate connection are well known, and one has only to look back on the modest beginning of the Rubber, Cinchona, and other important crops initiated by Kew, and which to-day rank amongst the most important and flourishing of all tropical enterprises, to appreciate the true value of the work that has been accomplished.

Then again Kew has sent out her "sons of the soil" to play their part in this important work, and from all accounts one might safely say that "they have done well."

It is hoped that the following short account of the history and progress of the Botanic Garden, Dominica, from their commencement in 1889 up to the present time, will serve as an example and show the interesting developments and the results possible of attainment with proper care, foresight, judgment, and perseverance, coupled with such valuable assistance as Kew alone is able to give.

The first steps towards the establishment of a Botanic Garden proper in Dominica were taken near the close of the year 1889, when Mr. Charles Murray of the Edinburgh Botanic Garden was appointed Curator.

In 1890 Mr. Henry F. Green of Kew succeeded Mr. C. Murray, who had been transferred to Grenada, and it was to Mr. Green that fell the work of beginning the laying out of the grounds of the present garden.

But, like his predecessor, Mr. Green was not destined to remain in Dominica; in 1892 he resigned and was succeeded by the present Curator, Mr. Joseph Jones of Kew, who, since his appointment in that year, has laboured without intermission and to-day can look back over 28 years' endeavour, the early stages of which must have called for much "spade work" to bring the department to its present state of beauty and utility.

Mr. Joseph Jones, as is usually the case with men who achieve great things, is exceedingly modest, and those who seek an account of things as they were in the early days need not refer to the excellent official guide of the Garden prepared by him, for they will be disappointed therein.

Beyond a short history of the Garden, nothing will be found in its pages to throw light on the formidable task and the difficulties that must have been encountered in the work of converting a rough piece of ground into a Botanic Garden.

Details of this kind, recounting the struggles of one who set out to make the best of things, must be patiently waited for until they fall unconsciously, one by one, from the lips of him who so modestly tries to hide them.

One instance may be mentioned where an interesting fact was revealed to me in this manner. This happened whilst discussing with Mr. Jones the merits of a large Bougainvillea, when I noticed, hidden beneath the bush, a huge stone measuring about 6 square feet. This, I was informed, was one of the many stones that were found on the ground when the Government bought the site, and had been preserved as a relic of those days; the others having been blasted out and used in the building of the wall that now separates the Garden from the public road, running from the Emsall Gate to the Curator's Gate, a distance of several hundred yards. This gave me ample proof of the original state of the ground, over which now stretches a beautiful lawn and, where the depth of soil has permitted, large trees are in a flourishing condition.

Contrary to what might be expected succulents do remarkably well in that Garden considering the heavy rainfall, even in this part of Dominica, which averages for the last 28 years over 78 ins. per annum. Up in the interior the precipitation may be as much as 300 ins. per annum !

A plant of *Cereus peruvianus* is now 35 ft., and, strange to say, withstood the hurricanes of both 1915 and 1916; it gives some idea of the success attending the cultivation of succulents in Dominica.

The situation of the Garden may be said to be ideal, for it stands on a comparatively flat piece of ground distant about 500 yds. from the sea, and immediately under the precipitous Morne Bruce.

The area of the Garden is approximately 42 acres, exclusive of nurseries, and a lime experiment station and other grounds, to be referred to later.

The Morne Bruce cliff, which rises to a height of 300 ft., gives to the Garden a wonderfully picturesque setting, and with its two spurs projecting at each end into the Garden forms a charming amphitheatre of greenery. This half circle takes in the whole of the eastern boundary and affords protection from prevailing winds.

During the flowering periods of native and exotic trees which have been planted up this slope, the colour effect produced by the mixture of these with shrubs and bushes of various shades of green, together with palms and bamboos waving to and fro in the breeze, presents a picture of rare beauty. It is difficult to describe the beauty of this slope. At the time of writing this the date-palms, with their greyish-blue* leaves and half ripe

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* Owing to the bloom, which gives to the leaves a decidedly greyish blue tint the writer had some difficulty in recognising the trees after having seen date-palms in Egypt.

yellow fruits, stand out in wonderful relief from the different shades of green, as do also the specimens of *Livistona chinensis* and *Washingtonia filifera*. The latter tower about 80 ft. in the air !

In addition to the contrast afforded by the palms with their masses of dead leaves neatly clustered round the base of the "head," the beautiful Bougainvilleas greatly enhance this wonderful blend of colour.

Ornamental Section.—The Garden is divided into two parts. That part known as the ornamental section is marked off from the economic section by a low wooden fence and occupies most of the flat land.

The lawns are extensive and well kept; the main lawn, which is used for cricket and boasts a pavilion, being over 2 acres in extent. Bounding this lawn on three sides are huge specimens of the Saman tree, (*Pithecolobium Saman*), on which are growing native and exotic orchids.

To complete the square on the east side of the lawn a border of mixed low-growing ornamental shrubs was planted instead of continuing the tall Saman trees, for this side of the lawn faces the forest-clad mountains of the interior, which give a distant background of great natural beauty.

The collection of flowering trees and shrubs, palms and other ornamental plants such as *Pandanus* spp., Bamboos, Conifers, succulents, &c., includes all the best and most showy kinds.

Such handsome trees as *Baikaea insignis* and *Steriphomia paradoxa* adorn the lawns. The collection of palms includes over 100 species !

A row of Cohune palms (*Attalea cohune*), planted near one of the gateways, have grown to a height of 40 ft. and attract a good deal of attention.

Palms have been planted singly, in bold mixed groups, and to form vistas.

The Talipot palm (*Corypha umbraculifera*), of which there are several specimens in different stages of growth, stands out distinct from all other palms that have been planted singly. The palms that have been planted in vistas include *Pritchardia pacifica*, *Raphia vinifera*, *Oreodoxa oleracea*, and *Caryota urens*.

The vista formed of the *Caryota* includes plants of all ages and stages of flowering, and is of special interest to those who know of the peculiar flowering habit of this palm. On reaching maturity it throws out an inflorescence from the top of the tree, continuing downwards from each axil, until the palm is exhausted, and dies. For the most part, with the exception of large trees, planting has been done in the group system.

Among those plants that have been so planted may be mentioned various Crotons, Hibiscus, and Pandanus; *Duranta Plumieri*, *Golphimia brasiliensis*, Gardenias, Tabernaemontanas, Aralias, and other plants.

Bougainvilleas, as well as the handsome climber *Norantea guianensis*, have also been planted in beds and kept trimmed to

give a dome-shaped appearance. The latter plant is particularly attractive during March and April, when it throws out spikes of red flowers, the spikes measuring in length from 2 to 4 ft.

Among the trees planted singly are included several timber and other trees which give excellent shade, but do not possess much value in floral beauty. They have, however, their place in the collection and add charm to the grounds.

Included among these trees are species of *Ficus* such as *F. elastica*, *F. Vogelii*, *F. altissima*, and *F. Benjamina*.

These trees, which have now reached huge dimensions, are growing here and there throughout the grounds, and afford excellent shade during the heat of the day to those who feel disposed to use the seats placed thereunder.

Flowering trees and shrubs such as *Amherstia nobilis*, *Saraca indica*, *Swartzia grandiflora*, *Tabebuia pentaphylla*, *Alstonia scholaris*, *Cananga odorata*, *Butea frondosa*, *Colvillea racemosa* and *Melaleuca Leucadendron*, along with several species of *Brownea*, *Ixora*, and *Bauhinia*, are among the best and do remarkably well.

Among the most important trees and shrubs grown on account of their ornamental fruits may be mentioned "The Sausage Tree," (*Kigelia pinnata*); *Dillenia indica*; "Jack Fruit," (*Artocarpus integrifolia*); "Cannon Ball Tree," (*Couroupita guianensis*); "Velvet Tamarind," (*Dialium guianensis*); *Kopsea fruticosa*; and *Carissa Carandas*.

Poinciana regia, and several species of Cassia, as well as *Lagerstroemia Flos-Reginae* and *L. indica*, and its variety *alba*, all have a place in the collection and give a wonderful display of colour in their respective seasons.

Creepers do exceedingly well and beyond keeping them in proper limits are left to take care of themselves. They include: *Beaumontia grandiflora*, *Camoensia maxima*, and *Aristolochia gigas* var. *Sturtevantii*.

Catalpa longissima, a West Indian tree, is used in these Gardens for creepers to grow upon and seems particularly well adapted to carry and display the Bougainvilleas.

In addition to the many varieties of the purple Bougainvillea, *B. laterita* (terra cotta) and a new introduction from Brazil by Mrs. Butt of a gorgeous free-flowering species, named after that lady, are also plentiful and thrive equally as well as the more common type.

Of the Conifers, *Juniperus bermudiana*, *Cupressus glabra*, *Pinus bahamensis*, *Araucaria Bidwillii* and *A. brasiliensis* do the best.

Economic Section.—On entering this section one's attention is attracted on all sides by the wonderful collection comprising most of the principal economic plants of the tropics.

Even the Date Palm of the sandy deserts, and the "Shea Butter Tree" (*Butyrospermum Parkii*), of Africa—probably the largest specimen outside that continent—are represented here.

The Citrus beds contain all the best kinds of oranges, Tangerines, Grape Fruits, Shaddocks, Pomelows, Lemons and Limes.

Several kinds of Coffee are grown, the two principal Vanillas, Cola nuts, most of the recognized rubber trees including the Landolphias, Nutmegs, Cinnamon, Camphor, Mangoes, Mangosteens, Durians, and other trees and plants of medicinal or other use to man.

Cocoa covers about 7½ acres of ground and is planted in ¼ acre plots, each of which receives different treatment in the two series of manurial experiments started in the years 1900 and 1907 respectively. Some of the plots occupy flat land, whilst the others are situated on the Morne Bruce slope.

This slope is typical of the rugged character of the land on planter's estates in different parts of the island, and on this account was selected for some of the plots to ascertain the manurial requirements of cocoa growing elsewhere in similar situations; as well as for comparing the results with those obtained from the plots on level ground.

To skim over things, as one must needs do in a paper of this kind, scarcely does justice to such an important part of agriculture as manurial experiments prove to be. It may, however, suffice to mention here that the experiments have been splendidly conducted and records carefully kept. At the time of writing the results of 20 years' work on the manurial experiments of cocoa are about to be published in the Annual Agricultural Report, and to all those who are interested in this crop they should furnish much valuable information.

Apart from the interesting results, these experiments have the additional merit of being the only ones of their kind conducted over such a long period of years.

It may be interesting to mention under this head that the crops from the cocoa plots, lime experiment plots, together with miscellaneous fruits and spices from other economic plants in the collection are a source of considerable financial support to the Department.

The receipts under the various heads for the year ended March 31st, 1920, were as follows :—

	£	*s.*	*d.*
Limes - - - - -	625	6	7
Cacao - - - - -	395	14	2
Nutmegs - - - - -	15	12	10
Cola Nuts - - - - -	12	8	1
Plants - - - - -	113	7	2
Fruit - - - - - -	26	12	7
Vegetable seeds - - - -	13	16	9
Cassia Pods - - - -	10	7	11
Miscellaneous - - - -	7	13	6
	£1,220	19	7

Nurseries.

The raising of plants at cheap rates to supply the needs of planters constitutes the work of this important and useful branch of the department. Here the planter can obtain at a small cost all the plants he may require for his estate, and is thus saved the trouble and inconvenience of having to provide them for himself.

To the new planter in particular these nurseries are of special value, for he is able to obtain a supply of young plants at any time to plant up his newly cleared forest land, which means a gain to him of at least 12 months in the case of lime plants, and nearly 2 years should he decide on budded trees of either Citrus or Cocoa.

With a steady increase in the demand for plants it became necessary in 1907 to extend the nurseries by taking in the only available piece of ground, which is situated on top of the Morne, and using it solely as a lime nursery; keeping the main nursery situated on a level with the Botanic Garden for budded Citrus, Sugar cane, Rubber, Coffee and miscellaneous stock, and such lime plants as might be required to supplement the principal supply at the Morne to meet the requirements of planters. The total area of these two nurseries is a little over 6 acres, in addition to which there is a shaded nursery where Cocoa, Nutmegs, and choice fruit trees such as grafted Mangoes, Mangosteens, Durians, &c. are grown in bamboo pots.

Near by stand two glass-roofed propagating houses with open sides used for raising seeds of a delicate nature and seeds which, if sown in the open ground, would be devoured by rats and birds.

The shaded nursery referred to above is of the ordinary type used in the tropics, consisting of a light frame work of wood, with a covering of wire netting, over which creepers are encouraged to grow to provide the necessary shade; the whole structure being supported by posts placed at regular intervals.

It may be mentioned that a section of this nursery is always kept stocked with large specimens of palms, flowering trees and shrubs, and economic plants growing in boxes ready to plant out in the places of those that may be blown down by a hurricane.

It is difficult for anyone to imagine the damage that can be wrought by a hurricane until he has seen the after-effects, or worse still, experienced one for himself.

The hurricanes of 1915 and 1916 did considerable damage. Apart from damage done in other parts of the island, where in some cases the tops of dense forests were blown away and huge trees and boulders washed down into the sea, the collection of trees in the Botanic Garden was so smashed up as to make the place almost unrecognisable to anyone who had seen it a few hours beforehand. So great was the damage that a special vote of money had to be expended in clearing up the grounds. In the Lime Experiment Station a whole series of experimental

plots was completely wiped out, many of the lime trees being carried away by the flood, whilst others were deposited on adjacent land.

In connection with nursery work in the tropics, the humus question demands careful attention. With the strong rays of a tropical sun beating on exposed land the humus of the soil is soon destroyed, and in order to prevent this it becomes necessary to provide a covering of mulch consisting of dried grass and leaves. The mulch not only serves as a covering, but eventually decays and thereby increases the humus content of the soil.

The nursery beds adjoining the Botanic Garden receive most of the cut grass from the lawns as well as leaves and other vegetable matter; whilst those at the Morne are supplied with dried grass from surrounding waste patches of land.

The method followed here where lime seedlings are grown on the same piece of land year after year is as follows:—the beds and the paths running between them are made the same width, the path being filled with cut grass which eventually decays; the following year the paths, in which the grass has been trampled under foot and thereby converted into a more or less decaying mass, are dug up and converted into beds, the beds of the previous year being made into paths. In this way the ground serving as paths for one year receives a good dressing of organic matter, and is rested for a period of 12 months.

In order to show the extent of the nursery work, a table of the yearly distribution of plants from 1905 to 1920 is given below:—

1905–6	65,731	1913–14	58,198
1906–7	83,000	1914–15	67,042
1907–8	53,855	1915–16	65,700
1908–9	67,596	1916–17	53,640
1909–10	79,009	1917–18	45,518
1910–11	69,295	1918–19	32,609
1911–12	76,363	1919–20	55,837
1912–13	75,146		

The average annual sale of plants during the above period is 63,236. In normal times, however, taking the period from 1905–6 to 1914–15, the average annual sale of plants was 69,523. During the war, as the above figures show, the annual sale of plants gradually decreased owing to the absence of many of the planters from the island who left to join the army.

In addition to nursery plants there is also a considerable distribution annually of seeds of rubber, coffee, green dressings, fodder grasses, shade trees, papaws, and vegetables.

Agriculture : Influence of Nursery Work.—Apart from supplying the immediate requirements of planters there has always been the experimental side of the work for the future improvement and welfare of the island.

Past experience of the coffee industry in Dominica, when this crop occupied a similar position to that of the Lime of the

present day, has shown that the practice of planting one crop to the exclusion of all others is one to be avoided. Up to that time limes, the present staple crop, had not been thought of in Dominica; indeed, sugar seems to have predominated after the failure of the coffee crop, and limes only came in gradually with the decline of the sugar industry, when beet began to take an important place in the world's supply of sugar, and the price of this commodity fell below the cost of production.

The agricultural history of Dominica from the coffee days shows that the dangerous policy of placing all one's eggs in one basket was adopted. And bearing in mind how much the future welfare of the island may depend upon securing suitable alternative crops and thereby avoiding a repetition of such a disaster as overtook agriculture in the coffee days, the importance of this nursery work will be understood.

Of late years cocoa planting has been encouraged by the department and every attempt made to extend its cultivation to districts which, prior to experimental work commenced on this crop, were considered unsuitable.

The superior Criollo type refuses to thrive in any part of the island, but it has been shown, after much pioneer work on the part of Mr. Jones in the budding and grafting of cocoa, that a good medium grade of cocoa can be grown in any part of the island, where cocoa might reasonably be expected to thrive, by grafting the Forastero type on the hardy Calabacillo stock. The Calabacillo type of cocoa in itself yields a very inferior grade of produce, but its immunity from disease, as well as its indifference to soil and climatic conditions, makes it invaluable as a stock for grafting; as by this means a medium grade of cocoa can be grown in places where the Forastero on its own stock would give poor results, and where the superior Criollo would possibly fail altogether.

Experimental onion growing was started a few years ago with a view to encouraging the cultivation of this crop to supply local needs. As an inducement to get planters and others to take an interest in this departure from orchard cultivation, seeds were imported from Teneriffe and sown in the nursery and the seedlings distributed free of charge.

Since the commencement of the experiment the demand for seedlings has rapidly increased. Following the lead of a successful grower several other planters have now come forward and placed definite orders with the Department for the purchase of onion seed to make them independent of the limited distribution of seedlings. Onions have become a remunerative crop, and local needs having now been satisfied, it is gratifying to note that another item has been added to the list of exports.

Buildings.

All the buildings, with the exception of stables and cart sheds, are situated near the Curator's office. In the Curator's office

space has been allotted to accommodate a very comprehensive and useful library.

Adjoining the office is a small but well equipped laboratory. Near by stands the class room, Foreman's house, tool and packing houses, potting shed, two propagating houses and a fumigator; the latter being used for imported seeds and plants which, when necessary, are brought straight from the Customs house and fumigated before the importer is allowed to take possession.

A few yards further away is situated a meteorological shed, and a cocoa drying house. The latter is of the ordinary type with sliding trays and a furnace to supply artificial means of drying when wet weather necessitates the trays being pushed back under cover. A considerable quantity of cocoa, nutmegs, and cola nuts, passes through this house in the course of a year.

Agricultural Instruction.

The present day system of agricultural training takes the place of the more elaborate provision of 20 years ago, when a grant of money from the Imperial Government allowed of from 20 to 25 boys being trained and accommodated in the old military buildings at the Morne. In those days the pupils, under the charge of an Agricultural officer of the Department, were fed and clothed and schooled in general agriculture, as well as in subjects of an elementary education, for which a schoolmaster was employed. Field work commenced at 7.30 a.m. and at 11 a.m. the boys were brought in and placed under the care of the schoolmaster until 4 p.m. when all instruction for the day came to an end and the boys were encouraged to take part in games and sports organised by the officer in charge.

It is interesting to record that at that time pedigree animals were kept for stud purposes and the care of these animals together with school gardens, and bee-keeping formed part of the boy's agricultural training.

The stock included :—

Horses, Donkeys, Cows, Sheep, Goats, Pigs, Rabbits, and Poultry.

The grant made by the Imperial Government for the upkeep of the Morne school was withdrawn in 1910, and, as the local Government was not in a position financially to take over the school and continue the good work on a similar scale, it became necessary in that year to dispose of the stock and close the buildings. The need of a system for training the youth of the island in agricultural methods after the closing of the Morne school was met by the local Government in 1911, when a small class room was erected in the Botanic Garden, and six boys were admitted as pupils for a period of two years. This system of training started in 1911 is in force at the present time.

When new pupils are required to take the places of those who have completed the course, an advertisement is inserted in the

local papers inviting candidates to present themselves at a competitive entrance examination, which is held by the Superintendent of Agriculture at the Botanic Garden. The pupils are then examined in the elementary subjects of a seventh standard public school, whereby some idea of their fitness to receive the agricultural course of training is fairly well ascertained.

The field work performed by the boys is of a light but useful nature, consisting of: Pruning lime trees, dressing wounds; mixing and applying insecticides and fungicides; sowing green dressing seed; budding limes; applying manures; pollinating vanilla flowers; planting nursery beds; potting cocoa, &c.

Practical demonstrations on tapping *Hevea brasiliensis*, and preparing rubber are also given. During their course of instruction in practical agriculture, the pupils are always under the supervision of an officer of the Department.

The subjects of class instruction are :—

Air and Water.
Soil and Drainage.
Manures.
Pests and Diseases of Plants.

Agricultural Botany.—Pollination and Fertilization, Elementary Physiology, pruning, grafting and budding, and other means of propagating plants.

Economic Botany or the cultivation and preparation of the principal economic products of the tropics with special reference to the West Indies.

The object of the agricultural training given to pupils is to fit them for taking up positions either as overseers or managers on planters' estates.

Many of the boys are the sons of peasant proprietors, and very often after completing the course of instruction at the Botanic Garden they return home and help their parents until old enough to take up planting on their own account.

Many such boys who have taken up planting have done remarkably well. The successful onion-grower referred to in a previous paragraph was at one time an agricultural pupil; to-day he is a prosperous planter, and a walk through his estate would convince the most sceptical of the benefits to be derived from a sound training in agriculture. Unlike many others, this planter believes in having more than one string to his bow, for in addition to Limes, Cocoa, Sugar, Coffee, Grape fruits, and Washington navel oranges; such crops as Maize, Onions, and French beans are also grown.

Other Efforts in connection with Agricultural Progress.—Since the inception of the Agricultural Department its energies have been directed to aiding all sections of the planting community.

With regard to instruction in agricultural matters, a Prize Holding Competition to encourage peasant holders was started in 1908. Cocoa was the principal crop grown.

Keen competition was shown amongst the peasants for the first year or two, but gradually their interest declined and fell off altogether in 1913.

With a depletion of the staff during the war, the Department was not in a position to make further efforts towards helping peasant holders, and now that the Lime Experiment Station has become established and very little time and opportunity is available for this kind of work, it has become a difficult matter to deal with; especially when such schemes involve close watching and frequent visits entailing considerable time upon tedious journeys over difficult country.

Courses of reading and examinations in practical agriculture were established under the direction of the Imperial Department of Agriculture for the purpose of enabling overseers on estates and others engaged in the practice of agriculture to acquire knowledge that would be useful in connection with their practical work. The scheme was successful and did much good until agriculture along with other industries was upset and disorganised by the war.

Now, when the war is over, high wages paid in America and elsewhere have had the effect of drawing away from the island many of the returned soldiers and efficient agricultural workers. Consequently the reading courses are still in abeyance and likely to continue so until those concerned show a desire to take advantage of an opportunity of extending their knowledge and fitting themselves for more remunerative positions.

Agricultural Cadet training.—The training which has been given for some years in Dominica and other West Indian islands received a set back in this island at the beginning of the war when the Science Master left the Grammar School.

This system of training is of a much higher grade than that of the ordinary agricultural instruction given to the sons of peasant holders, requiring, as it does, that those boys who wish to become Cadets must receive their education at the Grammar School.

Latin and Science are two subjects between which boys can make their choice after they have reached an advanced stage. Naturally those boys who intend taking up agricultural work select the science training under the Science Master, and thereby get a thorough grounding in such subjects as Chemistry, Botany, &c.

The science training given at the Grammar school is thus part of the cadet system, for as soon as the boys have completed their work at school they enter the Botanic Garden for a period of 12 months to gain an insight into the practical side of agriculture. By special arrangement a cadet may be allowed a further period of 12 months in the Garden if he so desires.

Laboratory Work.—The purpose for which this section of the Department was established has been well served since the erection of the laboratory in 1910.

The idea in fitting up a local laboratory in the Garden was to enable the Department to deal with the analysing of Lime juice, milk and other food stuffs, soils and manures, &c.

The gradual increase in the number of samples sent in for analysis shows that the Government laboratory in Antigua is gradually being relieved, so far as Dominica is concerned, of such work as might be safely and efficiently dealt with locally, with a saving of time and postal expenses.

The laboratory in Dominica, it should be mentioned, does not interfere in any way with the central laboratory in Antigua —supported by the Imperial Government for research work in the Leeward Islands—in regard to the more important chemical investigations. All important matters are still submitted to the Government Chemist in that island and only such work as is shown above has been undertaken locally.

Morne Bruce Lands.

Leaving the Botanic Garden and proceeding along a zigzag path, well protected from the sun by overhanging bamboos and native timber trees, the top of the Morne Bruce cliff is eventually reached.

Having arrived at the top one receives as a reward for the strenuous climb a refreshing breeze from the direction of the Windward coast—a pleasure which the people of the town of Roseau can only experience on the hill tops, for rarely does the wind blow in from the sea on the Leeward side, where Roseau and the Garden are situated.

At this point, looking up the Roseau Valley, the winding river can be seen making its way down from the rugged country above; whilst looking out towards the sea one views immediately below the full expanse of the Garden.

Between the Garden and the sea the red-topped houses and the steeples of churches peep out here and there from among the trees.

The contrast here is very striking; for down below we have the Garden representing purpose and order of things, and up in the country above, in the opposite direction, a wonderful scene of natural beauty.

Keeping straight along the edge of the cliff on the left hand side is a collection of Eucalpyts, which numbered seventy-two species prior to the hurricanes of 1915 and 1916; now, however, after the havoc then wrought the number of species is reduced to about fifty.

The Morne Bruce lime nursery already referred to is situated next to the Eucalyptus plot.

Adjoining this nursery is a piece of ground 2 acres in extent planted in Coconuts, Cocoa, Limes, Camphor, and Rubber,

(*Hevea brasiliensis*). Experimental tapping of the latter is being carried out at the present time.

On the right hand side of the road leading from this point to the Lime Experiment Station stands the Curator's house and Government cottage.

Before reaching the Lime Experiment Station the road passes under an avenue of Date and Coconut palms, and leads into a grass square on each of the four sides of which stands an old military building. These buildings have been used for many purposes since the military vacated them, including those of Reformatory School, Poor house, Isolation Hospital, and latterly as the Agricultural School already described.

Continuing along the road the Lime Experiment Station comes into view on the right. Standing on the road—only a few feet wide—which may be described as the crest of the ridge separating the Roseau valley from the valley in which the limes are growing, one obtains not only a good view of the Experiment Station below but also of the scenery of the rising land beyond.

As a rule the peaks of the tallest mountains are buried in the clouds, but on fine days, especially in the evenings, they stand out well defined against the clear sky.

Lime Experiment Station.

The area of the Lime Experiment Station is approximately 25 acres exclusive of the lower part of the valley near the sea, which is also Government ground and will be taken into cultivation gradually and planted with limes. In addition to Limes, Camphor, Coconuts, Grape fruits, Shea Butter trees, and green dressing crops are also grown.

These crops, however, do not take up much more than 9 acres of land; whilst the growing of green dressing crops is essential for mulching purposes in connection with the manurial experiments.

The mulch crops are grown on shallow patches of land near the mulch plots of each of the series of experiments, and they serve two purposes, viz.—supplying mulch to lime trees and demonstrating to planters how shallow patches of land in the vicinity of lime cultivations may be utilised.

The Lime Experiment Station has been in existence for seven years. Started in 1913 it took the place of a rather unsatisfactory system of experiments that had been in vogue on several estates in different parts of the island since 1901.

The need of undertaking experiments in the cultivation and manuring of limes had long been recognised; but no useful attempt was made to meet this need until 1913, when it was found that the many pickings involved, labour troubles, and inadequate supervision on estates stood in the way of accurate records being furnished. It became evident that the problem could only be solved by bringing together the whole of the plots

into one area, and conducting the experiments on sound lines under the direct management of the Agricultural Department. Fortunately the Government possessed land suitable for this purpose in the valley beyond Morne Bruce within easy reach of the Botanic Garden. This land is sloping in character and typical of conditions of large areas where lime cultivation in the island is carried on.

A distinct advantage which enabled experiments to be commenced almost at once was the existence on this piece of land of a considerable number of lime trees thàt had been planted in the year 1893 by the boys of the Reformatory school at Morne Bruce.

From the time of planting in 1893 the lime trees were properly cared for until the closing of the institution in 1895, when they were abandoned and allowed to become overgrown with bush a condition which lasted until 1913, the year the Agricultural Department took over the land for experimental purpóses.

Naturally the trees were found to be poor in condition and attenuated in appearance, but it was seen at the time that with a certain amount of trimming and proper attention given to drainage, they would soon pull round and develop into good healthy bearing trees.

Faulty planting necessitated many of the trees being permanently removed, whilst in some places fresh trees had to be planted to make up the plots with trees planted at suitable and equal distances apart.

All this had to be done before the plots could be lined out and manurial treatment commenced. Meanwhile, a patch of old pasture land near by was being planted with young limes and marked off into eight $\frac{1}{4}$ acre plots; the object being to duplicate with the young cultivation the experiments carried on with the older trees, thus confirming or otherwise the results. Further, it was hoped that the results would show to what extent old lime trees were capable of responding to manurial treatment.

It was intended that the experiments should be conducted in two series :

Series 1. With old trees (8 plots).
„ 2. With young trees (8 plots).

The scheme of manuring is outlined below :—

1. Complete manure.
2. Control—no manure.
3. Mulched with grass and leaves.
4. Nitrogen only (Sulphate of Ammonia)'
5. Nitrogen only (Dried blood).
6. Phosphate only (Basic Slag).
7. Potash only (Sulphate of Potash).
8. Phosphate and Nitrogen (Dried blood and Basic Slag).

These experiments were continued satisfactorily and a record of yields of the old trees, (series 1), kept until 1916, when the

hurricane of that year completely destroyed several of the plots and left others so badly battered that this series had to be abandoned.

The young trees in Series II. more or less escaped any serious damage, as at this stage of their growth they had not attained to a height of more than 2 or 3 ft.

The damage caused by the hurricane necessitated a reorganisation of the plots, and in 1917 the present system of experiments was laid out.

They are conducted in three series of 5 plots each :—

Series I. Original (Young lime trees).
„ II. Duplicate „ „ „
„ III. Triplicate (old trees found on the land).

The following treatment given to the five plots in series I. is repeated in series II. and III. :—

Plot 1. Complete manure (Dried blood, Basic Slag, Sulphate of Potash).
„ 2. Control—no manure.
„ 3. Mulch—Lemon grass and leguminous prunings at the rate of 5 tons per acre.
„ 4. Nitrogen and Phosphate (Dried blood and Basic Slag).
„ 5. Nitrogen and Potash (Dried blood and Sulphate of Potash).

The area of each plot is approximately $\frac{1}{4}$ of an acre. The trees are planted along the middle of a bed; there being 3 beds of eight trees, making a total of 24 trees to a plot. Each plot is divided from the next by a deep drain; and all such drains lead into a main drain, at the end of the plots, running at right angles.

Reliable and useful results from these experiments cannot be expected for some time to come. It would appear, however, that nothing short of a complete fertilizer can be expected to give satisfactory results; and further observations may show that mulch, such as cut grass and bush, will, when applied every second year alternating with a complete fertilizer, become an important consideration in every practical scheme of plantation manuring.

In addition to the main experiments other plots have been kept under observation since 1916, most of the trees having been planted in 1914. The most important of these consist of three plots planted with budded limes.

Plots A. and B. consist of ordinary spiny limes budded on sour orange stock, whilst plot C. is planted with the spineless* type also budded on the sour orange stock.

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* This spineless variety was discovered up in the interior by Mr. H. F. Green, of Kew, in 1890-92, when curator of these Gardens.

Compared with the ordinary spiny type its fruits are much smaller, and the bearing qualities of the tree are less prolific.

On the other hand, the rind of the fruit is much thinner than the ordinary lime, and the juice is more plentiful and much clearer, and it contains fewer seeds.

Although these three plots have undergone various treatments, the results of which are given below, the main object in planting budded trees was to ascertain whether, when budded on the sour orange, they could, by reason of the long tap root sent down by this stock, withstand the hurricanes through being more firmly anchored in the ground.

Another interesting matter was that of finding a stock immune from the *Rosellinia* root disease. Further it was hoped that the tendency to early bearing, which is characteristic of budded plants, might prove an advantage over the ordinary seedling which takes at least four or five years to come into bearing. As regards the immunity of the orange stock from attacks of *Rosellinia* disease, and the bearing qualities of the budded lime, (spiny type) no definite conclusions can be drawn at present to show whether or not these trees can be recommended for general planting.

The treatment given to these three plots commenced with the actual planting, when some of the holes were made with dynamite, and the others were made with the spade.

The results of the two methods compared showed that there was nothing to choose between one and the other. These results, being contrary to experience elsewhere with dynamite, led to the belief that the failure must have been due to the moist and compact nature of the soil, and that the use of dynamite on such lands only tends to further compaction.

Good results, it is reasonable to suppose, can only be expected on land where the shattering effect of dynamite will loosen the surrounding soil and make way for the penetration of the young roots, therefore it is not likely that the use of dynamite will meet with much success in Dominica.

The next phase of the experimental work on these plots yielded interesting and useful results: two of the three plots were planted with green dressing crops: one with Horse Beans, (*Canavalia ensiformis*), and the other with *Tephrosia candida*; the third plot being left bare except for the weeds and grass which were kept cut at regular intervals.

The object of this experiment was to show to what degree these crops would help in the development of the young trees by affording a ground covering from the strong rays of the sun, and acting as lateral protection from prevailing winds.

Observations made on lime cultivations by the Department, extending over a good number of years, have shown that the lime tree has a critical period in its lifetime, commencing at the time of planting in the field and continuing up to the third year.

During this period unless proper attention is given, the health of the tree may become impaired to the extent of permanently weakening its constitution, and very often at this stage scale insects and other pests appear.

An annual application of 2 lbs. of organic nitrogen per tree, in addition to green dressing crops, constitutes the treatment

that should be given during this period, and is mentioned here as having some bearing on the results of the experiments under consideration; for these three plots received the complete treatment necessary to bring the plant through this stage, with the exception of plot C. which received the fertilizer only.

The following table will show the results obtained :—

	A.	B.	C.
	Grown with Horse Beans.	Grown with Tephrosia.	Grown without Green Dressing.
	*Calculated yield in barrels per acre.	Calculated yield in barrels per acre.	Calculated yield in barrels per acre.
1917–18	34	33	24
1918–19	72	139	54

* One barrel = 4½ cubic ft. capacity.

It will be seen that the yield obtained from the plot of trees grown without green dressing compares unfavourably with those grown with Horse Beans and *Tephrosia*. Another interesting point worthy of note is the great increase in yield of B. over A. in the second year of bearing.

This may be due to the better protection afforded by *Tephrosia* which grows to a height of several feet, whereas the Horse Beans rarely attain to a height of more than 2 ft. The fact that *Tephrosia* is much slower in its growth from seed than the Horse Beans may account for the yields of A. and B. being about equal in the first year of bearing, when at that stage the *Tephrosia* would be in a more or less weakly condition, and would not give such effective protection as would the more sturdy growing Horse Beans.

When it is remembered that the ordinary seedling tree does not commence to bear until the fourth or fifth year, and even then only a few fruits are to be expected, the above results may be considered as remarkable instances of early bearing and, clearly demonstrate one of the advantages in planting budded trees.

Limes, unlike most other fruits, instead of being picked from the tree, are allowed to ripen and fall to the ground, when they are collected into baskets and conveyed to the mill.

The fruit collected from the plots in the Lime Experiment Station are deposited in heaps in front of the plots from which they have been collected, and after being carefully measured and the yields recorded are carted to the Bath Estate, the property of Messrs. Rose & Co., Ltd., to whom they are sold.

The present yield of limes from the whole of the Experiment Station is approximately 2,000 barrels per annum. As the newly planted land comes into bearing this figure should rise to between 3,000 and 4,000 barrels per annum, and later on with all the trees in full bearing between 6,000 and 7,000 barrels may be expected.

Some time in the near future it may be possible to deal with these limes in the factory which is now in course of construction in the Experiment Station. Such a factory will become an essential part of the experiments in connection with the lime industry, and may be expected to help the planter to solve a few of the difficulties that still remain to be overcome in regard to the manufacture of lime products.

Experimental work in the factory conducted in conjunction with field operations might bring to light a better means of working and improving the present lime industry, and show a more economical and profitable method of dealing with the lime from the time the tree leaves the nursery bed until its products are ready for the market.

VII.—KIKUYU GRASS.

(*Pennisetum clandestinum*, Chiov.)

O. Stapf.

In 1911 Mr. J. Burtt-Davy received from Mr. David Forbes of Athole, Amsterdam, Transvaal, a single root of a peculiar grass which he had collected on the shores of Lake Naivasha, Kikuyu, whilst hunting there, the grass having attracted his attention by the partiality which the wild game showed for it. The root was transplanted in one of the plots of the Botanical Station at Groenkloof, Pretoria, and soon established itself.* It has since flowered there regularly every year, but not seeded, the original plant and its descendants being apparently all functionally female.† In "The Farmer's Weekly" of March

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* A preliminary note announcing the introduction of the grass was published in the Report on the Department of Agriculture, Union of South Africa for 1910/1911, p. 241. Here also appears the name Kikuyu Grass for the first time.

† A short article by Mr. Burtt-Davy in the Agricultural Journal of South Africa, vol. ii., pp. 146–147, describes the experience gained with this grass in the Transvaal by them (1915), and deals with its uses and disadvantages. It also states the circumstances of its introduction, and that with some reserve it had been referred at Kew to *Pennisetum longistylum*.

23rd, 1917, Mr. H. A. Melle published a fuller account of the grass as it presented itself under cultivation, the greater part of which is reproduced here.

"Kikuyu grass (*Pennisetum longistylum*), says Mr. Melle, is a perennial, running grass, and like the 'kweek' forms a dense turf. It has branching, leafy stems. The leaves are flat and spreading. Kikuyu has numerous stout rhizomes, as thick as a lead-pencil, and by the growth of these a single plant may cover an area of several square yards. If grown in a vicinity where there is not much moisture it will make very little top-growth, but will send out shoots and spread along the ground and establish itself firmly. But in the presence of moisture it will put on top-growth. I have seen it grow $2\frac{1}{2}$ to 3 ft. high. As yet it has not been observed to set seed in South Africa although it flowers regularly at the Groenkloof Botanical Station every summer.

Kikuyu is a summer grass, but will remain green until the first severe frost and will start growing again long before the veld grasses. At the time of writing our mealies have been scorched by frost and the veld grasses have become coarse and dry; whereas the Kikuyu is still putting on growth and is beautifully green and succulent. Its drought resistant qualities have proved to be equal if not better than any of the other grasses.

Kikuyu may be considered as essentially a pasture grass. In districts where the rainfall is over 30 inches it might be possible to get two or three cuttings a season. What number of plants it can carry per acre has not been ascertained, but it will probably carry more than any other grass owing to its dense and rapid growth, combined with its resistance to eradication. If a sod of this grass be taken up, a few rhizomes (underground shoots) are always left in the ground; these in two weeks' time will send out green leaves and soon re-establish themselves.

As Kikuyu can only be propagated by roots or runners the initial cost of establishing a pasture would be more than other grasses that bear seed. This, however, is compensated for by the fact that when it has been put in, provided there is sufficient moisture in the soil to start it growing, it will take care of itself. There is, moreover, no fear of it becoming choked by weeds Although Kikuyu is such a hardy and vigorous grass it would be advisable to well prepare the ground previous to planting as it will then strike immediately and have an advantage over any undesirable plant.

(*a*) Palatability.—I can say with every assurance that Kikuyu is one of the most palatable grasses. All stock eat it greedily and will leave most grasses to get to it. If stock are allowed on a patch of Kikuyu it will be seen that they will graze contentedly, and when they have had their fill they like to lie down on it, for the Kikuyu forming such a dense turf provides a very comfortable rest.

(*b*) Chemical Analysis.—From the following table kindly supplied by the Division of Chemistry, it will be seen that Kikuyu is one of our most nutritious grasses :—

Air-dried Material.	Moisture.	Protein.	Carbo-hydrates.	Fat (Ether Extract).	Crude Fibre.	Ash.	Containing true Protein.	Nitrogen.	Albumenoid Nitrogen.
Kikuyu grass -	8·29	12·36	35·06	1·7	33·08	9·42	8·31	1·977	1·330
Guinea grass - (Panicum maximum)	8·02	9·03	28·63	1·68	40·54	12·10	7·09	1·445	1·134
Warm Baths grass (Digitaria sp.)	10·94	8·33	25·22	1·72	34·56	9·23	6·13	1·333	0·980
Vinger grass -	6·93	8·12	33·94	1·68	39·68	9·65	5·51	1·299	0·882
Blauwzaad grass (Eragrostis sp.)	7·91	6·58	43·78	1·80	34·50	5·43	5·43	1·053	0·868

Kikuyu grows well on any kind of soil but thrives best on moist vlei soil. We have it growing on alluvial vlei, on heavy clay loam, on gravel clay, on red loam, and poor impoverished stiff clay. On all these it is doing remarkably well. It is also known to do remarkably well on sandy soils.

Like all other grasses Kikuyu has also its disadvantages, and amongst these the chief are :—

(1) It is a summer grass as it does not remain green throughout the winter, unless watered and not subjected to frost.

(2) As it does not appear to form seed in this country, the only means of propagating it is by runners, hence freight, which involves additional expense. And it may happen that when it reaches its destination the ground prepared for it may not have sufficient moisture to start it growing. Although this is enumerated as a disadvantage it may also be considered as an advantage; yielding no seed there is no fear of it establishing itself voluntarily in an adjoining field.

(3) Being such a hardy and persistent grower when once established, it will be very difficult to eradicate. We have a good illustration of this on the Station. About a month ago we disposed of large quantities of Kikuyu and the patch from which we took the grass three weeks ago was apparently quite clean but now is beautifully green and almost covered with Kikuyu.

(4) Kikuyu is so aggressive that no other plant can grow with it. This is a great advantage because when planted on the veld it will establish itself against any of our veld grasses of minor feeding value.

(5) There is a likelihood of a Kikuyu pasture becoming sod-bound and if this should happen, the field should be disked and ploughed or harrowed.

(6) It is only natural that a plant of such vigorous growth as Kikuyu would soon impoverish the soil.

Kikuyu responds generously to manure, for where there are animal droppings on a patch it will be noticed the grass grows there higher than anywhere else.

Lawns have been grown from this grass around the laboratories of the Botanical Division and on the terraces of the Union Buildings, Pretoria. The bright, light green colour of the foliage forms a lovely setting for ornamental gardening. It will also make an excellent field lawn as it forms a dense, soft and springy turf when closely grazed or clipped.

On account of its ability to grow on practically any type of soil and its creeping characteristics, it should be an excellent soil binder, on dam walls, on sandy soils and on eroding slopes and dongas.

Then again it can be recommended as a grass for planting in a poultry-run. Fowls seem very fond of the leaves, and owing to its aggressive nature it can withstand the ravages of the fowls' scratching, &c.

As Kikuyu is easily propagated by cuttings it may be either planted by cuttings or 'roots.' Our practice is to take the grass out in sod, then cut it up into pieces about 3 ins. square and plant it out 6 ft. by 6 ft., or 6 ft. distant between the rows and 3 ft. distant in the rows. Our results have shown that when planted 6 ft. by 6 ft. on fairly good soil it covers the ground in a single season.

Kikuyu being a summer grass the best time of planting is during the spring and summer rains, but it can be planted as late as April when the frosts do not occur before May.

In order to recover the cost of preparing the ground for Kikuyu it is possible after the last cultivation of mealies to put down Kikuyu between the rows."

Subsequently an attempt was made to introduce the grass into Mashonaland. The success seems to have been complete, as may be seen from the following note in the Rhodesia Agricultural Journal, vol. xv. (1918) p. 327 :—

"Kikuyu Grass.—As late as a year ago it was mentioned in an article in the *Rhodesia Agricultural Journal* (June, 1917) that, despite all efforts up to then, no pasture grass had been discovered suitable for Rhodesia which formed a thick bottom and might prove useful for grazing purposes. Since that date, however, our trials with Kikuyu grass (*Pennisetum longistylum*) on the prevailing red soils of Mashonaland have shown that this grass adapts itself perfectly to local conditions, and fulfils all the expectations that have been aroused from reports concerning its behaviour in the Union. The first lot of roots introduced by the Department of Agriculture were obtained from the Potchef-

stroom experiment farm in March, 1917. Through delays, these arrived in a seemingly dead condition, and after a preliminary soaking were planted out. Practically no rain fell after planting, yet by December, 1917, considerable growth had been made, and the runners became the source of our principal propagation plots. A further lot of slips were imported from Natal in December, 1917, and were planted out one foot apart each way. The resulting plot as it appeared in June, 1918, is shown in the accompanying illustration. The slips soon covered the ground entirely, and the growth was so vigorous that the paths and adjoining beds were invaded. The spreading power of this grass is one of its most remarkable features, and not only does it spread along the surface of the ground, but its runners penetrate downwards to a considerable depth in the course of a single season, making its hold upon the ground very firm, and rendering it hardy against tramping. In view of its known excellent feeding qualities, its vigour and its adaptability to Rhodesia, it can be confidently recommended. It is expected that slips in limited quantities will be available for distribution during the coming season."

When in 1915 the first very meagre specimens of the grass reached Kew from Pretoria they were recognised as identical with some fragments of a *Pennisetum* which in 1906 had been received from Mr. A. Linton among pieces of *Cynodon Dactylon*, collected at "Linoru" (evidently meant for Lamoru, the first railway station west of Kikuyu). Both were then considered to be probably stunted and very much reduced forms of *Pennisetum longistylum*, a conception corresponding more or less to Leeke's treatment of the plant as a var. *clandestina* of the same species "congrua—— et cum forma normali evidenter consanguinea." However, after the accession of better material from East Africa, and the experience gained in the Transvaal, namely, that improved conditions did not affect the peculiar structure of the grass, it became evident that the extreme reduction of the inflorescence and the stunted condition of the vegetative parts were not casual features impressed on the plant by an especially unfavourable habitat, but fixed and perfectly definite characters of specific rank. This was also the conclusion Pilger came to when describing the grass which he had from Lamoru (collected by G. Scheffler in 1909), as a new species, *Pennisetum inclusum* (in Engler's Jahrb. xv. p. 209). Further search in the literature on *Pennisetum*, however, showed that Pilger had been forestalled by Chiovenda who had already in 1903 (Annuar. Ist. Bot. Roma, viii. p. 41) accorded the grass the status of a species, taking up an unpublished name of Hochstetter's "clandestinum" as nomen specificum. Chiovenda's species was based on a specimen of Schimper's, 2084 (no locality stated), which is not represented in the collection at Kew and the British Museum at London, nor was the species itself recorded in the Index Kewensis. Chiovenda's description, however, and his figure leave no doubt

as to the identity of the plant. Thus the Kikuyu grass will have to be known under the name proposed by him, namely, *Pennisetum clandestinum*, Hochst. ex Chiov.

The two most striking features of *Pennisetum clandestinum* (*see* Figs. 1 and 2 on p. 91) are its stunted growth and proclivity to the formation of very vigorous runners, and the extreme reduction of the inflorescence and its inclusion in the top sheath. In habit it resembles strong specimens of *Cynodon Dactylon* to a remarkable degree, so much so that barren specimens of both may be all but indistinguishable. The anatomical differences are, however, obvious, as will be seen from the cross sections shown on p. 91 (Figs. 11 and 12). Grown in good and well-watered soil it throws up barren stems up to 30 cm. (according to Melle, l.c., even 1 m.) high with elongated internodes (up to 7 cm.) and long slender blades (up to over 20 cm. by 3–4 mm.), whilst the flowering shoots seem to remain short (5–6 cm.) even under such favourable conditions (Figs. 3 and 4). The reduction of the inflorescence (Fig. 5) affects not only the number of spikelets (2–4), but also the involucral bristles which are short, the longest not surpassing three-quarters the length of the spikelet, delicate and eplumose and have evidently lost their function; further, the glumes, the lower of which is quite suppressed, whilst the upper is merely a small nerveless or almost nerveless scale; the lower floret which is reduced to its valve and finally the stamens which are occasionally arrested, the flowers becoming thereby functionally female (Figs. 6–10). The valves share the relatively great number of nerves (11–14) with those of *P. longistylum*, but they are narrower, longer, thinner and in the lower part almost devoid of chlorophyll—no doubt in response to their concealed position. The genetic derivation of *P. clandestinum* from *P. longistylum* is obvious, but the power of reversion to its ancestral type seems to have been lost. The reduction of the inflorescences to so few spikelets—and of these sometimes a portion only fertile—must mean poor seeding, a loss amply balanced by the vigour of the vegetative reproduction of the grass by runners and stolons. The area of *P. clandestinum* extends from Eritrea to Mt. Elgon and the highland of West Usambura. *P. longistylum* on the other hand is so far only known from Northern Abyssinia, and the adjoining parts of the Italian colony of Eritrea.

The following is a description of the grass :—

Pennisetum clandestinum, *Hochst.* ex *Chiov.* in Annuar. Ist. Bot. Roma, viii. 41, t. v. Fig. ii. (1903). A hermaphrodite or sometimes unisexual low creeping closely matting perennial with creeping rhizome and slender stolons with very short internodes, throwing up single or more often fascicled short stout branches, the underground portion of which is densely covered with downwards more or less decayed leaf-sheaths. Culms (over-ground stems and branches) very short, often hardly raised above the ground or growing out into long rooting runners appressed to

For explanation of figures see *p.* 93.

the ground and copiously branching to the right and left with the branches short, stout, closely sheathed and shortly ascending (*see* note on cultivated specimens below). Leaf-sheaths closely imbricate, mostly 1·2–1·6 cm. long, very rarely longer, almost membranous, very pale, then turning brown, distinctly nerved, glabrous or sparingly and shortly hirsute; ligules reduced to a densely ciliate rim; blades spreading, linear, gradually passing into the sheath, tapering to a subobtuse point, 1·25–5 cm. by 3–4 mm. (flattened out), tightly folded, then opening out, subsucculent, more or less glaucous, glabrous or sparingly and shortly hirsute, rough on the margins and the subcarinate midrib towards the tip, otherwise smooth, midrib slender, prominent below, primary lateral nerves 2–3, more or less differentiated below only. Inflorescence reduced to a cluster of 4–2 (mostly 3, rarely 1) spikelets, subsessile and enclosed for the greater part in the uppermost leaf-sheath, the terminal spikelet shortly pedicelled, the others sessile, each spikelet supported by an involucre of delicate bristles; bristles of the terminal involucre up to 15, very unequally long, the longest and strongest about $\frac{3}{4}$ the length of the spikelets, of the lateral involucres similar but much fewer and only on the outer side of the spikelet. Spikelets bisexual or functionally unisexual, slender, linear-lanceolate, 1–1·75 rarely 2 cm. long, glabrous, whitish below, greenish upwards. Lower glume suppressed, upper ovate to ovate-rotundate, subobtuse, up to 2 mm. long, hyaline, obscurely few-nerved. Lower floret reduced to its valve, this lanceolate, long tapering, subacute, as long as the spikelet, thinly membranous, 11–9-nerved. Upper floret ♂ + ♀ and markedly protogynous or functionally ♀ with rudimentary stamens; valve very similar to that of the lower floret, but slightly shorter; valvule linear-lanceolate, long acuminate, very thin, 4–2-nerved. Lodicules 0. Stamens ♂ ♀ with very long, protruding filaments (up to over 25 mm. long) and dangling anthers, 5–7 mm. long, of the ♀ much reduced with linear-subulate filaments slightly exceeding the ovary and empty anthers, 3 mm. long which remain permanently enclosed in the floret. Ovary obversely pear-shaped, attenuated into the long-exserted filiform style which is up to 3 cm. long, simple or shortly 2-fid and finely plumose from below the middle upwards. Grain (almost mature) dorsally compressed oblong-elliptic in outline, over 2 mm. by 1 mm. long, brown; hilum punctiform, black (Figs. 1–11, p. 91). *P. longistylum* (?) Stapf ex Burtt-Davy in Agric. Journ. South Afr. II. (1915) 147. *P. l. var. clandestina*, Leeke, Untersuch. Abstamm. u. Heimat d. Negerhirse, 23 (1907); Chiov. in Annuar. Ist. Bot. Roma, viii. 319 (1908). *P. inclusum*. Pilger in Engl. Bot. Jahrb. XLV. 209 (1910). *Cynodon Dactylon*, Schweinf. in Bull. Herb. Boiss. II. App. ii. 31 (1894), not Pers.

Distribution.—Eritrea, Ocule Cusai; by the Dégra stream near Saganeiti, *Schweinfurth* 1257 (barren)! Abyssinia; Samen;

Sabra District, Selenka, on dry spots in wet meadows, 2750 m., and at Debra Eski, in dry grassy places, 2870 m., *Schimper* 398 ! Schoa, Ankober, *Roth* 62 ! Uganda; Mount Elgon, common on open ground in the bamboo zone, 2600 m., *Dummer* 3614 ! British East Africa; near Lamoru, *Linton* 215 ! and near the same place in low bush at 3000 m., *Scheffler* 294 ! Nairobi, *Dowson* 185 ! Tanganyika Territory : West Usambara 1600 m., *Eichinger* 3294.

Melle (*see* above) has pointed out that Kikuyu grass in the presence of water will put on top-growth and attain to a height of $2\frac{1}{2}$–3 ft. A specimen from the Groenkloof Botanical Station (H. D. Agr. 19059) shows such a drawn up shoot (Fig. 4). It is about 1 ft. long, with 11 or 12 leaves, and the 6th and 7th internodes measure 5 and 6·5 cm. respectively; the corresponding sheaths are roughly of the same length, whilst their blades measure 18 and 23 cm. respectively, by about 5 mm. when unfolded. The accompanying flowering specimens stand 5 cm. above the ground, with about 7 leaves and blades 3–7 cm. long.

The flowers are as in all the allied species protogynous (Figs. 1, 2). Reduction to a functionally female condition is characteristic of all the cultivated specimens from the Transvaal as far as I have been able to examine them, and it also occurs in those collected by Roth at Ankober; but whilst the anthers of the cultivated specimens were quite devoid of pollen, those from Ankober contained beside some empty pollen grains numerous pollen-mother-cells which had not got beyond the stage of division and were loosely scattered through the anther which had dehisced.

1 and 2. Flowering branches in the female (1) and male stages (from Lamoru, Scheffler, 294). 3 and 4. A flowering (3) and a barren (4) shoot (Groenekloof, Botanical Station; cult.). 5. A whole inflorescence of a female plant (Groenekloof). 6. Upper glume. 7 and 8. Valves of lower (7) and upper (8) floret. 9. Valvule of upper floret. 10. Rudimentary stamens and ovary of a female plant. 11. Part of a cross section (including midrib) of a blade of *Pennisetum clandestinum*. 12. Same of *Cynodon Dactylon* for comparison.

VIII.—MISCELLANEOUS NOTES.

William Alexander Talbot.—This well-known and much esteemed Indian Forest Officer died on July 23rd, 1917, at the Château de Rougemont, near Château d'Oex in Switzerland. Appointed to the Indian Forest Department in 1875, he attended the Nancy Forest School and went out to India in 1876. His service there was all in the Bombay Presidency where he rose to be a Conservator of Forests in 1901. He early came into touch with Kew through his "Trees, Shrubs and Woody Climbers of the Bombay Presidency," published in 1894, and through the numerous excellent specimens which he continued to contribute to the Kew Herbarium up to the time of his retirement in 1909.

But the work by which Talbot is best known to the botanical world is his "Forest Flora of the Bombay Presidency and Sind," a large quarto work in two volumes, profusely illustrated by his sister Miss E. S. Talbot, and published in 1909 after his first book had been through two editions. Talbot's name was commemorated by Sir J. D. Hooker in the Balsam, *Impatiens Talboti*.

S. T. D.

The Imperial Bureau of Mycology.—The following statement recording the establishment of the Imperial Bureau of Mycology has been received for publication by the Director from the Rt. Hon. The Secretary of State for the Colonies :—

The Imperial Bureau of Mycology is the outcome of a proposal unanimously adopted by the Imperial War Conference in 1918 that a central organisation should be established for the encouragement and co-ordination of work throughout the Empire on the diseases of plants caused by fungi, in relation to agriculture. The Committee of Management consists of some of the foremost biologists in the country, with Viscount Harcourt as their Chairman, and includes the following members :— Professor Sir Isaac Bayley Balfour, F.R.S., Mr. W. Bateson, F.R.S., Professor V. H. Blackman, F.R.S., Professor F. O. Bower, F.R.S., Mr. A. D. Cotton, F.L.S., Professor H. H. Dixon, F.R.S., Professor J. B. Farmer, F.R.S., Captain A. W. Hill, F.R.S., Professor W. H. Lang, F.R.S., Sir Daniel Morris, K.C.M.G., Mr. J. Murray, Mr. G. H. Pethybridge, Sir David Prain, C.M.G., C.I.E., F.R.S., Dr. A. B. Rendle, F.R.S., Mr. H. N. Ridley, C.M.G., F.R.S., Professor R. A. Robertson, F.R.S.E., Sir A. E. Shipley, F.R.S., Professor W. Somerville, F.R.S., and Dr. H. W. T. Wager, F.R.S.

Dr. E. J. Butler, C.I.E., late Imperial Mycologist, Director of the Research Institute, Pusa, and Agricultural Adviser to the Government of India, has been appointed Director, and has started work at the headquarters of the Bureau, No. 17, Kew Green, Kew (Telephone : Richmond 603); this site has the advantage of proximity to the fine library and collections of the Royal Botanic Gardens, with the Director and staff of which the Bureau will work in co-operation.

The funds of the Bureau are entirely provided by contributions from the various self-governing Dominions, India, Egypt, and the Soudan, and the non-self-governing Colonies and Protectorates. It will work broadly on the lines of the existing Imperial Bureau of Entomology at South Kensington, and will aim at doing for the other great class of destructive agencies in agriculture, namely, the diseases and blights of plants caused by fungi, what the older Bureau has so successfully done in regard to injurious insects. It will be a central agency for the accumulation and distribution of information and for the identification of specimens sent in from all parts of the Empire. It is proposed to issue, as soon as funds permit, a periodical journal

through which those interested in mycological work in regard to agriculture will be kept informed of progress elsewhere. There are at present over 50 officials engaged in this work in the Overseas parts of the Empire, while the number of agriculturists, planters, and the like practically interested is legion.

The effect of fungus diseases in reducing crop production is great beyond calculation. A Canadian scientist has estimated the loss caused by rust in wheat in the prairie region of Canada in 1917 at 100,000,000 bushels, representing a value of between 25,000,000*l.* and 50,000,000*l.* For the same year the loss in the five chief cereals in the United States exceeded 400,000,000 bushels. The effect of this on the provisioning of the world may be easily imagined.

The Date Palm (*Phoenix dactylifera*) **and its Cultivation in the Punjab.**—"The extraordinarily high temperature, the extremely dry atmosphere and the plentiful supply of soil water required to grow dates successfully, is a combination extremely difficult to find, and limits date cultivation to a very few places on the face of the earth." These are the concluding words of the author of the above-named work and the desired conditions he seems to have found in the Punjab. One feels that the opinion carries some weight, because it is supported by experience in the Egyptian Sudan, a land which from the beginning of time almost has been associated with the date-palm. His argument is intended to show, and rightly so, that over-production is practically impossible, notwithstanding the fact that it is also common in Southern Europe, North Africa, and the Orient; cultivated in other parts of India, Baluchistan, California, Arizona, Texas, Australia, Canary Islands and many hot, dry countries. Dried dates are imported into the United Kingdom from British India, Persia, Egypt, Gibraltar, &c., and particulars have been given in the Bulletin of the cultivation in South Australia (1895, pp. 161–162), Antigua (1896, pp. 26–28), Bussorah (1898, pp. 46–50), and Mesopotamia (1908, pp. 283–286), together with one (1914, pp. 159–162) on the sex of the seedlings—always a cause for grave anxiety as to the right proportion of male and female trees when seeds are relied on as a means of increase. Amongst authors of the comparatively few publications of recent years on the subject may be mentioned Watt (India, 1892), Fairchild (U.S. Dept. of Agric., 1903), Swingle (U.S. Dept. of Agric., 1904), Fletcher (India and countries other than India, 1906), Blatter (India and Ceylon, 1911), Popenoe (California, 1913), Brown (Egypt, 1916), and Annett (Bengal, 1913 and 1918).

The present additional work, however, is none the less timely and valuable. In desert regions, like that of the Sahara, for instance, the fruit is of first importance to the inhabitants, and

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* The Date Palm and its cultivation in the Punjab by D. Milne, Economic Botanist, Lyallpur (published for the Punjab Govt., 1918), pp. 1–153 and 50 illustrations.

everywhere the persistent and increasing demand for food must be met by the further development of plants suitable to the conditions obtaining in any particular country. There are seven chapters bearing on general requirements, soil and climate, propagation, pollination, fruit preservation, diseases, &c., and a glossary. The illustrations include photographic and diagrammatic, and especially attractive amongst the latter are the diagrams relating to the root system, showing numbers and positions of secondary roots, in sections of the soil, 3 ft. wide and 7 ft. deep, at various distances of from 4–10½ ft. away from the tree, and the author concludes that "as a very large proportion of the roots only spread to a distance of a few feet from the stems explains why considerable crops of fruits can be got even when the trees are growing very close together, as they usually are in date-growing regions, and, as far as the root system is concerned, it seems to indicate that if only dates were grown a full return would not be got from the land if the trees were planted further apart than 20 ft." This knowledge of the root-system is of the utmost importance in a cultivation depending almost entirely on irrigation, and it serves a useful purpose also in the application of manures.

The same close attention to detail is obvious throughout the whole of the work, which should prove of value to anyone interested in the cultivation of this palm. J. H. H.

College Botany.*—The number of elementary botanical text-books published in English must be a high one. Each usually has both good and bad points, and the work noticed here is no exception to this general rule. The author is professor of Plant Pathology and Cecidology at Rutgers College, N.J., and has already published a text-book of "Applied Botany." The subject, in the work now under notice, is dealt with in such a manner as to present as many different phases of botany as possible, and to give the student a very general and very broad view. This method of teaching, which has found particular favour in America, has many advantages as well as some obvious disadvantages. Naturally, when nearly every branch of the science is introduced, it is only possible to give outline details which sometimes tend to degenerate into dogmatic statements. Dr. Cook's book aims to make a combination of the elementary principles of pure and applied science, but the result seems an unequal mixture rather than a combination. The most satisfactory feature of the book is the reproduction of many excellent photographs. The subjects for these are uniformly well selected. The outline text-figures are some clear, many indifferent and several seriously inaccurate. W. B. T.

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* College Botany, Structure, Physiology and Economics of Plants by M. T. Cook, J. B. Lippincott Co., 1920, 12/6 net.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 3] [1921

IX.—THE GENERA OF FUMARIACEAE AND THEIR DISTRIBUTION.

J. Hutchinson.

Fumariaceae is now generally recognised as a family distinct from the *Papaveraceae* proper. It is noteworthy, however, that in both Bentham and Hooker's Genera Plantarum (i. 54), and Engler and Prantl's Pflanzenfamilien (III. ii. 130), it stands as a subfamily and tribe respectively of *Papaveraceae*. As a separate family it was first described by A. P. DeCandolle in his "Systema" (ii. 105; 1821), again in the "Prodromus" (i. 125; 1824), and by Lindley in his "Vegetable Kingdom" (ed. 3, 435, 1853). Endlicher (Gen. Pl. 858; 1836) ranked the group as a subfamily. The present writer is not so much concerned as to whether the *Fumariaceae* should be regarded as a family or a subfamily.* In his opinion it is quite distinctly separated as a group from *Papaveraceae* proper, and nearly as closely allied to certain genera of *Berberidaceae*, such as *Epimedium*, *Aceranthus* and *Bongardia*. That there is close affinity with certain *Papaveraceae* is quite evident, especially with *Chelidonium* and allied genera. But it is probable that this alliance is more apparent than real, and that the *Fumariaceae* have not arisen directly from the ancestors of the present *Papaveraceae*.

In 1821 DeCandolle (ll. cc.) recognised six genera of *Fumariaceae*, (1) *Diclytra*, Borckh. (*Dicentra*), (2) *Adlumia*, Raf., (3) *Cysticapnos*, Boerh., (4) *Corydalis*, DC., (5) *Sarcocapnos*, DC., and (6) *Fumaria*, Linn. In addition to these six, Endlicher in 1836 (l.c.) gave descriptions of six more genera, namely, *Hypecoum*, Linn., *Chiazospermum*, Bernh., *Dactylicapnos*, Wall., *Phacocapnos*, Bernh., *Discocapnos*, Cham. & Schlecht., and *Platycapnos*, Bernh. Lindley in 1853 added *Capnites*, Dum., *Leonticoides*, Lindl., and *Aplectrocapnos*, Boiss. & Reut., bringing

* *See* Bernhardi, "Über den Charakter und die Verwandtschaft der Papaveraceen und Fumariaceen" in Linnaea, viii. 401–477 (1833): and xii. 651–668 (1838).

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the total up to fifteen. Bentham and Hooker (l.c.) reduced this number to seven, in which they were followed by Prantl and Kundig in Engler & Prantl, l.c. In regard to the classification of the *Papaveraceae* by the last-mentioned authors, it should be noted that their arrangement differs widely from any other proposed in that they interposed the "Papaveroideae" between the "Hypecoideae" and "Fumarioideae." As thus classified we have at the beginning of the family two genera with dimorphic petals and four stamens, in the middle a large group of genera (the *Papaveraceae* proper) with uniform petals and numerous stamens, and at the end the "Fumarioideae" with very zygomorphic flowers, dimorphic petals and six stamens united into two bundles. This classification seems unnatural, for whatever status the groups take, the "Hypecoideae" and "Fumarioideae" should undoubtedly form one principal group with further subdivision, and the "Papaveroideae" a second principal group to be dealt with likewise. This course is adopted here, after a careful examination of all the species of the two families represented at Kew, and the present account deals with *Fumariaceae*, divided primarily into two subordinate groups, *Hypecoideae* and *Fumarioideae*.

In regard to the number of genera which may be recognised, it will be seen that there is considerable divergence of opinion in general systematic works. But authors of local floras and smaller systematic papers have as a rule taken the genera in a more limited sense. Mr. Pugsley* has recently published a very careful revision of the genus *Fumaria*, from which he has separated and revised the genus *Rupicapnos*, at the same time pointing out the desirability of recognising the genera *Platycapnos*, Bernhardi, and *Discocapnos*, Cham. & Schlecht., all of which had been reduced to *Fumaria*. I agree with this recommendation, and in order to apply the same principles to the other genera of the family, the following classification is proposed. In the case of the smaller genera, I have also taken the opportunity of giving the records showing their distribution, which is presented in more graphic form on the accompanying maps. No new genera are proposed in the present paper.

Geographical Distribution.—*Fumariaceae* are most abundant in the north temperate parts of the Old World, especially around the shores of the Mediterranean and in the Himalaya-Yunnan Mountains. Central and South America, Tropical Africa (except the high equatorial eastern mountains), South India, Malaya and Australasia are entirely destitute of *Fumariaceae* excepting weeds of cultivation such as *Fumaria officinalis*. South Africa, however, has four small endemic genera, widely separated geographically from any other members of the family (*see* map, p. 105).

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* H. W. Pugsley, "A Revision of the genera *Fumaria* and *Rupicapnos*" in Journ. Linn. Soc. Bot. xliv. 233–255 (1919).

These isolated Cape genera form the most remarkable feature in the distribution of *Fumariaceae*, suggesting independent origin.

The three genera forming the distinct and most primitive group *Hypecoideae* have each a separate distribution (*see* map, p. 101). *Hypecoum* extends from South-West Europe to Turkestan and the North-West frontier of India. *Chiazospermum* occupies a more north-easterly area, from Soongaria to North-East China; whilst *Pteridophyllum* is endemic to Central Japan.

Dactylicapnos, which is here restored to generic rank, and *Dicentra* also occupy separate areas, the former from North-West Himalaya to Yunnan, the latter from Szechuan eastwards through Central China to the Eastern United States (*see* map, p. 105).

Other genera of very restricted distribution are the four that occur at the Cape of Good Hope, *Phacocapnos*, *Cysticapnos*, *Trigonocapnos*, and *Discocapnos*. *Sarcocapnos* (*see* map, p. 105) and *Rupicapnos* are confined to the Western Mediterranean, in Spain and North-West Africa, while *Ceratocapnos*, a genus of two very closely allied species, has one in North-West Africa, the other in the Holy Land. *Adlumia* has a wide range in the Eastern United States, and Professor Komarov,* a few years ago, made an interesting phytographical announcement in recording this interesting plant from Corea.

Corydalis is the most widely distributed genus of the family (*see* map, p. 109), occurring almost throughout the temperate zone of the Northern Hemisphere, but absent from Mediterranean North Africa, entering the tropic only in the mountains around Lake Victoria in Tropical East Africa, where two species have been discovered during the last few years, one, as yet unnamed, by Mr. Snowden, at 9,000–10,000 feet on Mt. Elgon, the other *Corydalis Mildbraedii*, Fedde, by Dr. J. Mildbraed in the mountains near Lake Kivu at an elevation of 7,700 feet. There is no true *Corydalis* in South Africa.

Fumaria is also widely spread in the Northern Hemisphere, but is absent from North America except as a weed of cultivation.

Key to the Genera of Fumariaceae.

Subfamily I. **HYPECOIDEAE.** Stamens 4, free, opposite the petals, the latter not very dissimilar, erect-patent; corolla actinomorphic.

Leaves much divided; peduncles 1-flowered, terminal or leaf-opposed:

Fruits not completely transversely septate, bivalvular; lateral lobes of inner petals emarginate; seeds with several flat sides - - 1. **Chiazospermum.**

* Komarov in Act. Hort. Petrop. xxii. 343.

Fruits completely transversely septate, breaking up into 1-seeded parts or subindehiscent; lateral lobes of inner petals entire; seeds turgid; Medit. Eur. to W. China - - - 2. **Hypecoum.**

Leaves pectinately pinnatisect, all radical and fern-like; inflorescence a leafless raceme; Japan - - - 3. **Pteridophyllum.**

Subfamily II. **FUMARIOIDEAE.** Stamens 6, united into two bundles; petals erect, the inner more or less connivent at the apex; corolla zygomorphic.

Tribe I. Corydaleae. Fruits usually dehiscent; ovaries with two or more ovules;

*Fruits not dimorphic:

Petals not or only shortly united in the lower part:

Fruits capsular, bivalved:

Two outer petals saccate at the base:

Inflorescence leaf-opposed; climbers with tendriliform terminal leaflets: Himal. and West China - 4. **Dactylicapnos.**

Inflorescence radical or axillary; low herbs; leaves not tendriliform; W. China to N. Amer. - 5. **Dicentra.**

Only one outer petal saccate or spurred at the base, the other flat:

Leaves without tendrils (except the W. Eur. *Corydalis claviculata*); N. Hemisph.:

Flowers bracteate, usually several or many in a raceme, rarely solitary - 6. **Corydalis.**

Flower ebracteate, solitary and scapose; Turkestan - - - 7. **Roborowskia.**

Leaves more or less tendriliform; S. Africa:

Capsules compressed, lanceolate - - - 8. **Phacocapnos.**

Capsules bladder-like, subglobose - - 9. **Cysticapnos.**

Fruits small, flat, indehiscent; ovules 2; S.W. Eur. and N. Afr. - - - 10. **Sarcocapnos.**

Petals completely united below; climber; inflorescence axillary - 11. **Adlumia.**

Fruits dimorphic, the lower ones truncate, 1-seeded and indehiscent, the upper ones lanceolate, bivalved and narrowed into a beak; inflorescence leaf-opposed - - 12. **Ceratocapnos.

TRIBE II. FUMARIEAE. Fruits indehiscent, 1-seeded; ovule solitary;

Fruits asymmetrical, winged on one side; S. Afr. - - - 13. **Trigonocapnos.**

Fruits symmetrical:

Usually perennials, nearly stemless; leaves mostly radical; inflorescence subcorymbose; fruits tubercular-rugose - - 14. **Rupicapnos.**

Annuals with elongated stems and cauline leaves; inflorescence racemose:

Fruit a more or less turgid nut; N. Hemisph.:

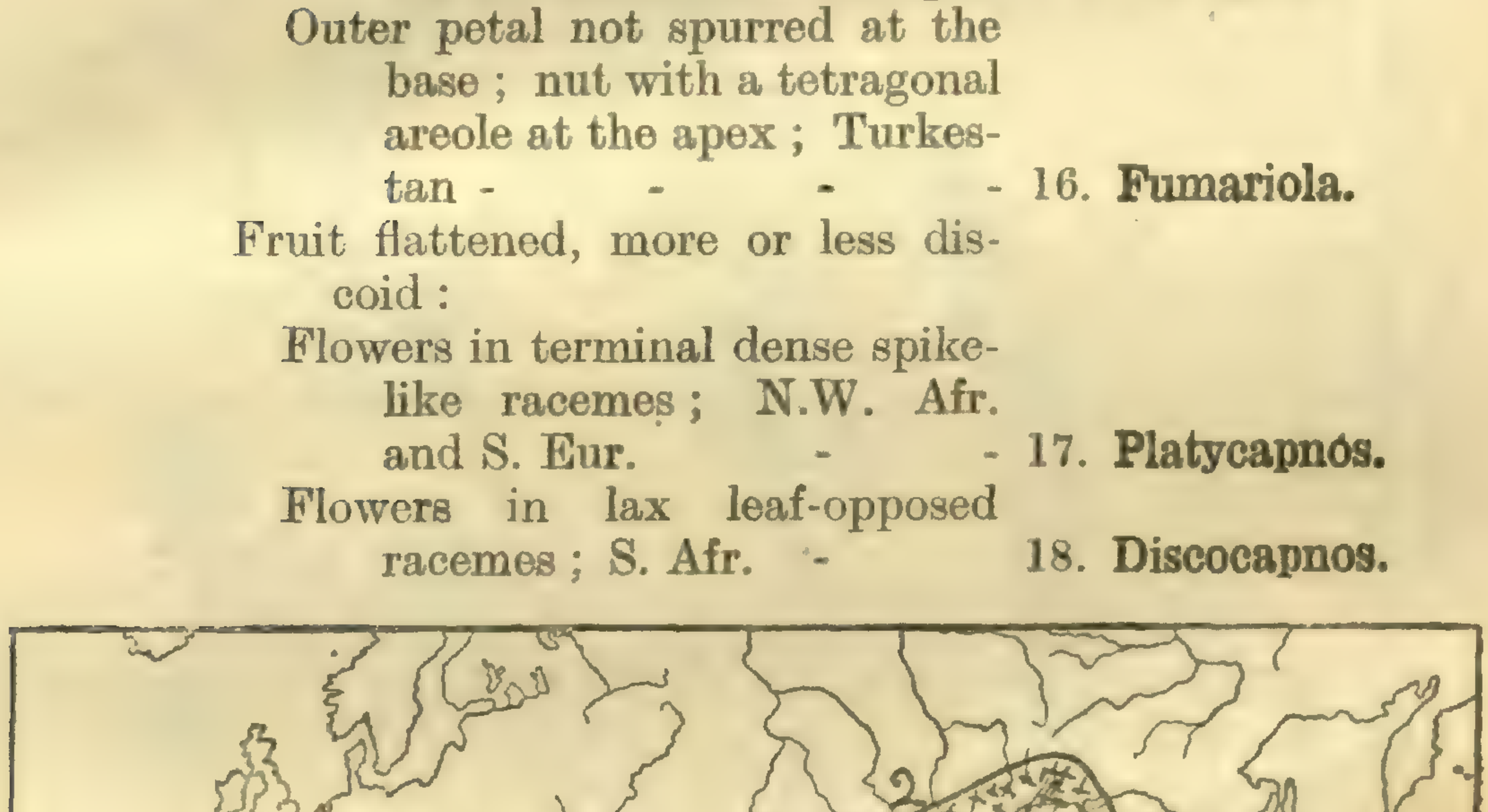
Outer petal spurred at the base; nut not areolate at the apex 15. **Fumaria.**

Outer petal not spurred at the base; nut with a tetragonal areole at the apex; Turkestan - - - - 16. **Fumariola.**

Fruit flattened, more or less discoid:

Flowers in terminal dense spike-like racemes; N.W. Afr. and S. Eur. - - 17. **Platycapnos.**

Flowers in lax leaf-opposed racemes; S. Afr. - 18. **Discocapnos.**



Approximate range of genera of subfamily **Hypecoideae** :—
1. ***Hypecoum.*** 2. *Chiazospermum.* 3. ***Pteridophyllum.***

1. **Chiazospermum,** *Bernh.* in Linnaea, viii. 465 (1833).

Flowers yellow - - -	1. **C. erectum.**
Flowers milky white, suffused with lilac - - - - -	2. **C. lactiflorum.**

1. **C. erectum,** *Bernh.* in Linnaea, xii. 662 (1838); Ledeb. Fl. Ross. i. 93 (1842); Turcz. Fl. Baic.-Dah. i. 101 (1842–5). *Hypecoum erectum*, Linn. Sp. Pl. 124 (1753); DC. Syst.. ii. 104 (1821); Prodr. i. 124 (1824); Fedde in Engler. Das Pflanzenr. Papaveraceae, 97 (1909).

NORTH ASIA. Siberia: Around Lake Baikal, *Herb. Petrop.*! *Turczaninow* (1830)! Northern Mongolia: Tannu-ola, *Potanin* (1879)! Muni-ula, *Przewalski* (1871)! Chinese Soongaria: at Lake Saisang-Nor, *Herb. Petrop.*! North-East China: near Peking, *Bushwell*! *Bretschneider* 56! *David* 2348! Peking, sandy wastes near the Hunho, *Hancock* 56!

2. **C. lactiflorum,** *Kar. et Kir.* Enum. Pl. Song. in Bull. Soc. Nat. Mosc. xv. 142 (1842); Ledeb. Fl. Ross. i. 745. *Hypecoum erectum*, var. *lactiflorum*, Maxim. Enum. Pl.

FIG. 1.—A. Capsule of *Chiazospermum erectum*. B. *Hypecoum Geslinii*, showing floral parts and dehiscence of fruits (after Cosson).

Mong. 36 (1889) ; Fedde in Engler, Das Pflanzenr. Papaveraceae, 97 (1909).

North Asia. Soongaria : near Arganaty Mts., *Karelin & Kiriloff* 1183 ! Northern Mongolia : Altai Mts., *Potanin* (1877) ! Gobi Desert, *Younghusband in Herb. Calcutta* (fide Prain in Herb. Kew).

2. **Hypecoum,** *Linn.* Gen. ed. i. 32 (1837).

For revision of this genus of 14 species *see* Fedde in Engler, Das Pflanzenreich, Papaveraceae, 85 (excl. *H. erectum*, Linn.).

Distribution.—Mediterranean Europe and North Africa to Western China ; *see* map, p. 101.

3. **Pteridophyllum,** *Sieb. & Zucc.* in Abh. Akad. München iii. ii. 719, t. 1 (1843). Fedde in Engler, Das Pflanzenreich, Papaveraceae, 83, Fig. 12 (1909).

P. racemosum, *Sieb. & Zucc.* l. c. 720. Stapf in Prain, Bot. Mag. t. 8743 (1918).

Central Japan. Kai Province : Mt. Komagatake, *Takeda* 13 ! Shinano Province, *Science Coll. Herb. Imp. University, Japan* ! Nambu Province, *Tschonoski* !

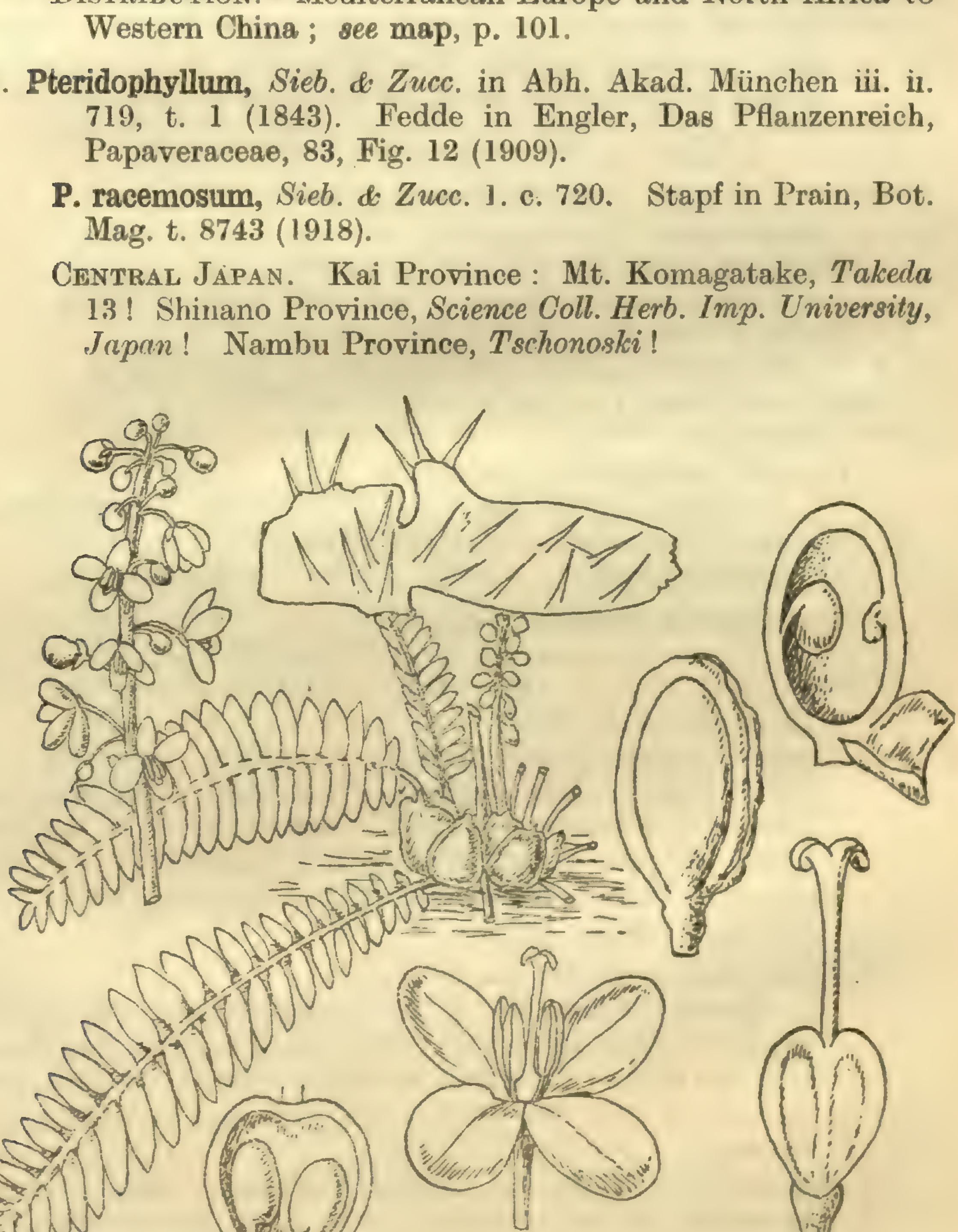


Fig. 2.—*Pteridophyllum racemosum* (adapted from Bot. Mag.).

4. **Dactylicapnos,** *Wall.* Tent. Fl. Nepal. 51, t. 39 (1828). Prain in Journ. As. Soc. Beng. lxv. 11 (1896) under *Dicentra.*

Wallich's genus *Dactylicapnos*, referred by the authors of the Flora of British India to *Dicentra*, is here restored. As Prain (l.c.) has pointed out these Himalayan plants "differ widely from all the North Asian and North American forms" [of *Dicentra*]. In geographical distribution, also, the two genera do not overlap, *Dactylicapnos* being essentially Himalayan (Kumaon to the Khasia Hills and Western and Southern Yunnan), whilst *Dicentra* occupies a more northerly area from Western Szechuan (Mt. Omei) through Hupeh (Cent. China) to Kamtschatka and the Western and Eastern States of North America and Canada (*see* map). The differences between the two genera, as here understood, are shown in the key on p. 105.

* Key to the Species of *Dactylicapnos.*

Bracts elongate ; capsules narrow, linear, coriaceous :	
Bracts as long as the pedicels ; capsules torulose, seeds opaque - -	1. **D. torulosa.**
Bracts shorter than the pedicels ; capsules not torulose ; seeds shining -	2. **D. Roylei.**
Bracts very small ; capsules broad ; seeds shining :	
Capsule membranous, acute at both ends, early dehiscent - -	3. **D. Macrocapnos.**
Capsule fleshy, ovate-cordate, tardily or not dehiscent - - -	4. **D. scandens.**

1. **Dactylicapnos torulosa,** *comb. nov.*

Dicentra torulosa, Hk. f. & Thom. Fl. Ind. 272 (1855) ; Fl. Brit. Ind. i. 121 (1872) ; Prain in Journ. As. Soc. Beng. lxv. 12 (1896).

Assam. Khasia Hills : Nungklow, 1300 m., up to 10 feet high, yellow, July–August, *Thos. Lobb* ! 12 October, *Hooker & Thomson* ! Moleen, *Griffith* 832 (Kew Distrib. 152) ! October 11, fr., *Hooker & Thomson* !

Yunnan. Yunnanfu, *Ducloux* 253 ! Szemao, 1500 m., fls. yellow, *A. Henry* 13361 !

2. **Dactylicapnos Roylei,** *comb. nov.*

Dicentra Roylei, Hk. f. & Thoms. Fl. Ind. 273 (1855) ; Fl. Brit. Ind. i. 121 (1872) ; Prain in Journ. As. Soc. Beng. lxv. 12 (1896). *Corydalis scandens*, Franch. in Bull. Soc. Bot. Fr. xxxiii. 391 (1886) ; Pl. Delavay. 44 (1889), non Spreng.

North-West Himalaya. Near Nagkanda, beyond Simla, in woods 2800 m., 26 July, *Herb. J. R. Drummond* 6359 ! Simla, fl. September, *Lady Dalhousie* ! Mussoorie, fr. 14 April, *Royle* 1040 ! *Falconer* (Kew Distrib. 118) !

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* This key is a copy of that published by Prain in Journ. As. Soc. Beng. lxv. 11 (1896) under *Dicentra.*

Sikkim. Choongtam, 1500 m., *Hooker*! abundant 2400–3400 m., *Hooker*!

Bhutan. *Griffith* 1748 (Kew Distrib. 153)!

Khasia Hills. Kulong, fr. 8 July, 1250 m., *Hooker & Thomson*!

Yunnan. Kichan, near Tali, *Delavay*! plains near Lichiang, 2800 m., Aug. 3, *C. Schneider* 2104!

3. **Dactylicapnos Macrocapnos,** *comb. nov.*

Dicentra scandens, Hk. f. & Thoms. Fl. Ind. 273 (1855); Fl. Brit. Ind. i. 121 (1872), non Walp. *Dactylicapnos thalictrifolia*, Wall. Cat. n. 1426/2 (1829) nec Tent. Fl. Nepal. *Macrocapnos*, Royle ex Lindl. Nat. Syst. ed. 2, 439 (1836); Royle Ill. 68 (1839). *Dicentra Macrocapnos*, Prain in Journ. As. Soc. Beng. lxv. 12 (1896).

North-West Himalaya. Kumaon: Jageren, 2000 m., *Strachey & Winterbottom*! Without definite locality, *Edgeworth* 77! Garhwal: near Badreenath, *Falconer* 119! Below Binsur, 1600 m., *Madden*!

4. **Dactylicapnos scandens,** *comb. nov.*

Diclytra scandens, D. Don. Prodr. Fl. Nep. 198 (1825). *Corydalis scandens*, Spreng. Syst. Veg. iv. 265 (1827). *Dicentra scandens*, Walp. Rep. i. 118 (1842); Prain in Journ. As. Soc. Beng. lxv. 13 (1896), which see for additional synonymy.

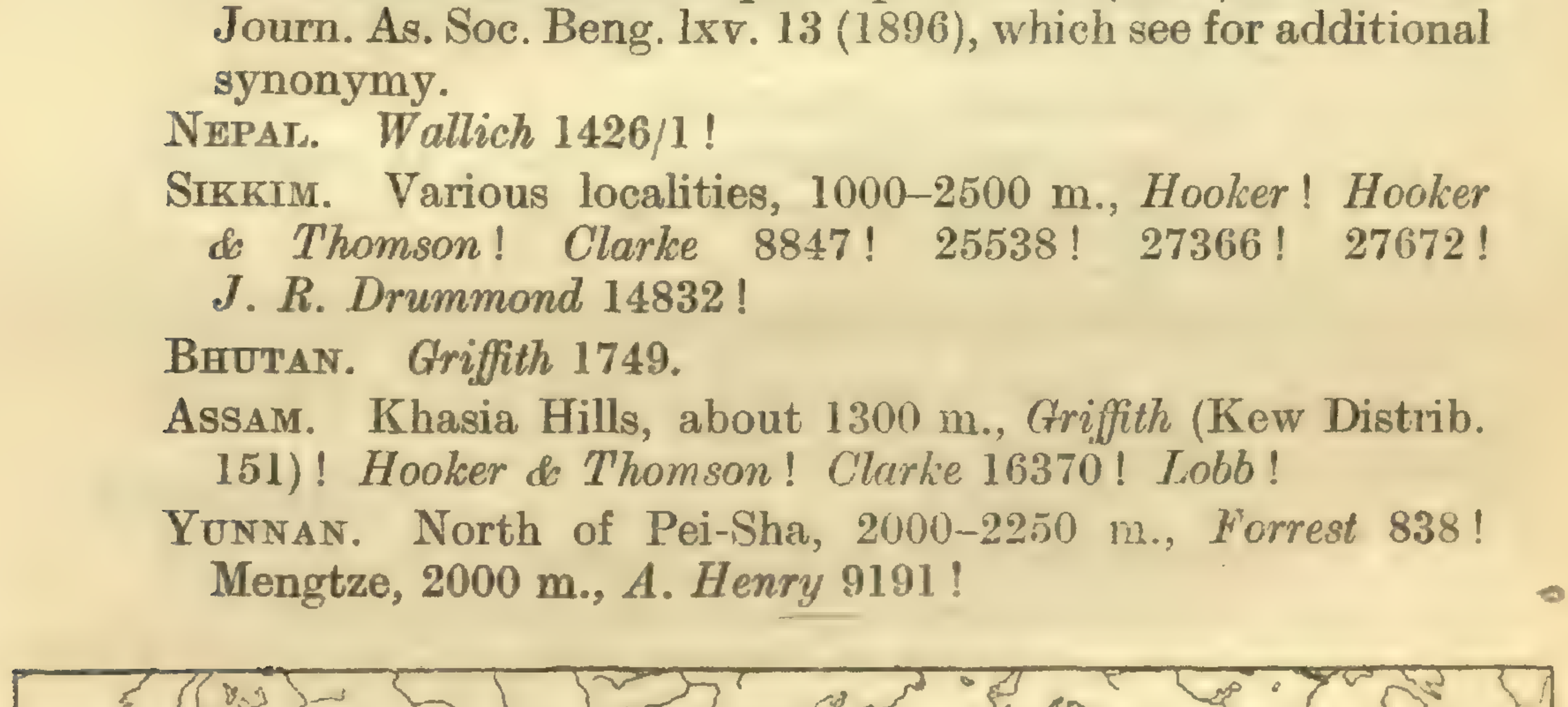
Nepal. *Wallich* 1426/1!

Sikkim. Various localities, 1000–2500 m., *Hooker*! *Hooker & Thomson*! *Clarke* 8847! 25538! 27366! 27672! *J. R. Drummond* 14832!

Bhutan. *Griffith* 1749.

Assam. Khasia Hills, about 1300 m., *Griffith* (Kew Distrib. 151)! *Hooker & Thomson*! *Clarke* 16370! *Lobb*!

Yunnan. North of Pei-Sha, 2000–2250 m., *Forrest* 838! Mengtze, 2000 m., *A. Henry* 9191!



Approximate range of 1, *Ceratocapnos*; 2, *Dactylicapnos*; 3, *Dicentra*. 4, Area in South Africa occupied by *Phacocapnos*, *Cysticapnos*, *Trigonocapnos*, *Discocapnos*.

Dicentra,* *Bernh.* in Linnaea, viii. 457, 468 (1833); Asa Gray, Synop. Fl. N. Amer. i. 93 (1895).

KEY TO THE SPECIES.

Section I. **Cucullaria.** Stemless plants with scapose inflorescence.

Series A. *Fibrosae.* Roots fibrous, long and slender; Asiatic species:

Inflorescence simple; E. Siberia - 1. **D. peregrina.**

Inflorescence branched laterally; Japan - - - - 2. **D. pusilla.**

Series B. *Repentes.* Rhizome creeping, not tuberous; N. Amer. species:

Petals united to above the middle; tips of outer petals not acuminate; Western Unit. States - 3. **D. formosa.**

Petals early separating to much below the middle; tips of outer petals acuminate; Eastern Unit. States - - - - 4. **D. eximia.**

Series C. *Tuberosae.* Tuberous rooted, or rhizome bearing small tubers; N. Amer. species:

Inflorescence several-flowered:

Flowers cordate at the base - 5. **D. canadensis.**

Flowers widely sagittate at the base:

Spurs about 8–10 mm. long; Eastern States and Canada- 6. **D. cucullaria.**

Spurs about 12 mm. long; Rocky Mt. States - - - 7. **D. occidentalis.**

Inflorescence 1–3-flowered; Western United States:

Tip of outer petals shorter than the body, remaining erect or suberect; lower part deeply pouched at the base; inner petals not hastate in the middle - - - 8. **D. pauciflora.**

Tip of outer petals longer than the body, soon abruptly reflexed, shallowly pouched at the base; inner petals strikingly hastate in the middle - - - 9. **D. uniflora.**

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* The name *Dicentra* is reserved by the International Bot. Congress of Vienna, 1905, in preference to the older names *Capnorchis*, Borckh., *Bikukulla*, Adans., *Diclytra*, Borckh., and *Dielytra*, Ch. & Sch.

Section II. **Chrysocapnos.** Caulescent and branched perennials.

Series A. *Luteiflorae.* North American species; flowers yellow, thyrsoid-paniculate:

Flowers 1·5–2 cm. long; outer petals soon spreading or recurving to below the middle; inner petals dorsally crested, with a long white crisped wing - - 10. **D. chrysantha.**

Flowers 2–2·5 cm. long; outer petals with only the tips spreading; inner petals with purple tips and large crest - - - 11. **D. ochroleuca.**

Series B. *Speciosae.* East Asiatic species; flowers racemose or racemose-paniculate.

Outer petals recurved in the upper half, pink, deeply pouched at the base; leaflets not serrate - 12. **D. spectabilis.**

Outer petals not recurved, yellow, scarcely pouched at the base; leaflets serrate - - - 13. **D. macrantha.**

In the following enumeration of the species of *Dicentra* the detailed geography and synonymy of the American species are not given. For these the reader is referred to Asa Gray, Synop. Fl. N. Amer. i. 93 (1895).

1. **Dicentra peregrina,** *Makino* in Bot. Mag. Tokyo, xxii. 162 (1908).

Fumaria peregrina, Rudolph in Mem. Acad. Sci. Petersb. 1. 379, t. 19 (1803–6). *Dicentra tenuifolia* and *D. lachenaliaeflora,* Ledeb. Fl. Ross. i. 97 (1842).

North-East Siberia. Ajan River, *Tiliny*! Ochotsk Sea, *Wright*! Mt. Segneka, *Herb. Acad. Petrop.* 1844! Mountain top by Moikeshi Bay, Eetrup, *T. Ishikawa*!

2. **Dicentra pusilla,** *Sieb. & Zucc.* Abh. Akad. Muench. iv. ii. 172 (1843).

Japan. Top of Shiranesan, in small crater, *Roberts*! Zowozan, *Science Coll. Imp. Univ., Japan, Herb.*!

3. **Dicentra formosa,** *Walp.* Rep. i. 118 (1842); Asa Gray, l.c. 95.

Distribution.—British Columbia to Central California.

4. **Dicentra eximia,** *Torr.* Fl. N. York, i. 46 (1843); Asa Gray, l.c. 95; Britt. & Br. Fl. N. St. & Canada, ii. 143, f. 1987 (as *Bicuculla*).

Distribution.—Western New York to mountains of Virginia, North Carolina and Tennessee.

5. **Dicentra canadensis,** *Walp.* Rep. i. 118 (1842); Asa Gray, l.c. 94; Britt. & Br. Fl. N. St. & Canada, ii. 142, Fig. 1986 (as *Bicuculla*).

DISTRIBUTION.—Nova Scotia to Lake Michigan, Pennsylvania and Kentucky.

6. **Dicentra Cucullaria,** *Bernh.* in Linnaea, viii. 468 (1833); Asa Gray, l.c. 95; Britt. & Br. Fl. N. St. & Canada, ii. 142, Fig. 1985 (as *Bicuculla*).

DISTRIBUTION.—Nova Scotia to Minnesota, south to N. Carolina (mountains), Missouri and Kansas, Westward to Washington Co., Oregon.

7. **Dicentra occidentalis,** *Fedde,* Repert. x. 315 (1912).
Bicuculla occidentalis, Rydb. Bull. Torr. Bot. Cl. xxix. 160 (1902).

DISTRIBUTION.—Oregon to Washington and Eastern Idaho.
I am indebted to Dr. N. L. Britton, Director of the New York Botanic Garden, for sending me a flower of this species.

8. **Dicentra pauciflora,** *S. Wats.* Bot. Calif. ii. 429 (1876); Asa Gray, l.c. 94.

DISTRIBUTION.—N. California; on Scott Mts., near snow, and at lower elevations near Castle Lake.

9. **Dicentra uniflora,** *Kellogg* in Proc. Calif. Acad. Sci. iv. 141, with Fig. (1871).

DISTRIBUTION.—Washington (Mt. Adams) to Sierra Nevada, California, and through Utah to Wyoming.

10. **Dicentra chrysantha,** *Walp.* Rep. i. 118 (1842); Asa Gray, l.c. 95.

DISTRIBUTION.—California, dry hills.

11. **Dicentra ochroleuca,** *Engelm.* in Bot. Gaz. vi. 223 (1881).

DISTRIBUTION.—Southern California.

12. **Dicentra spectabilis,** *Lem.* in Fl. des Serres, Ser. I. iii. t. 258 (1847).

DISTRIBUTION.—China: Patung District, *A. Henry* 3725! Mts. of Saimaji, Prov. of Sching-King, *Ross* 233! Chienshan *Ross* 386! Without definite locality, *Fortune* 38! Around Pekin, *Bretschneider*! Japan: near Hakodate, *Albrecht*! *Hodgson*! Commonly cultivated.

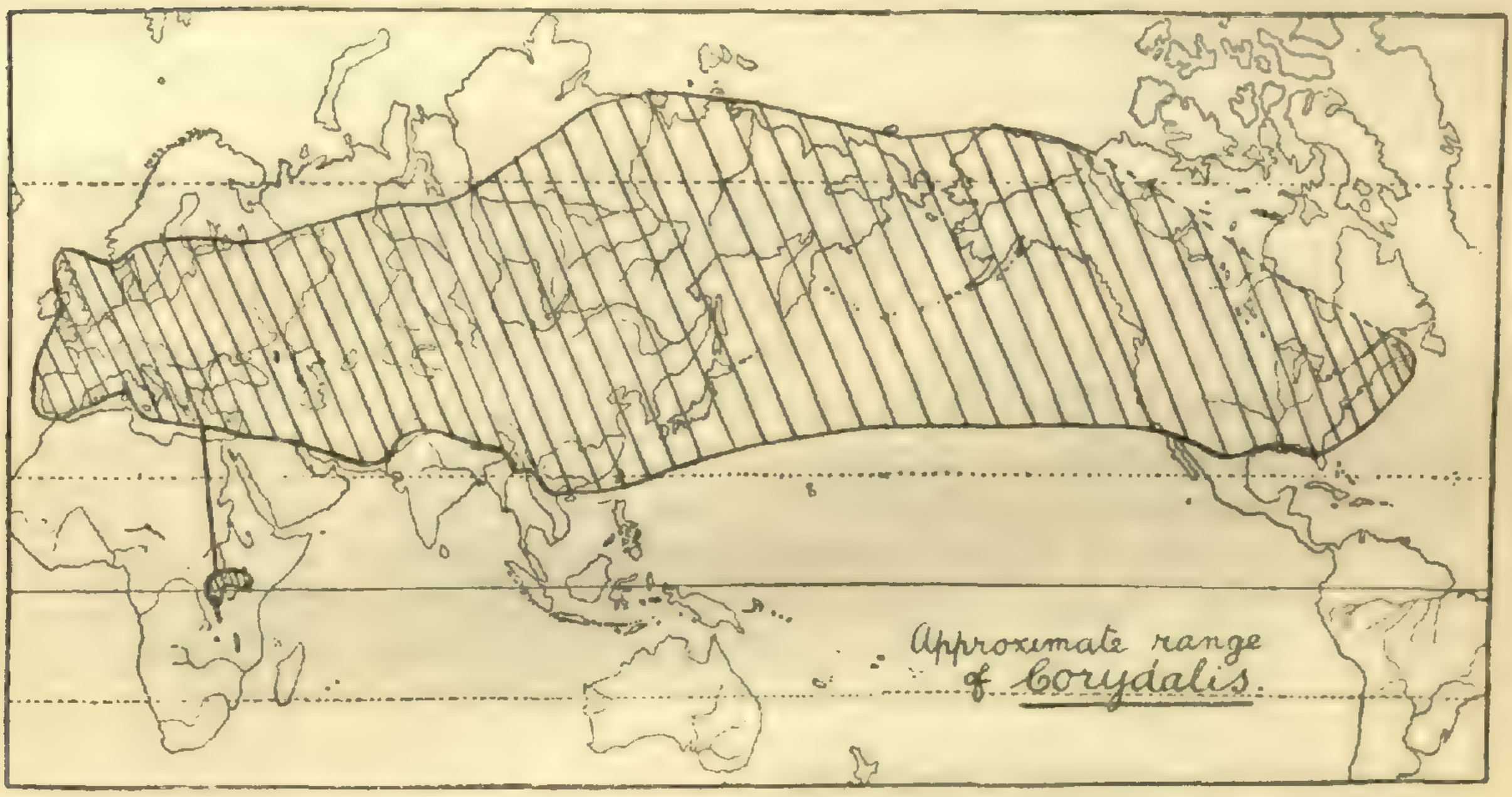
13. **Dicentra macrantha,** *Oliv.* in Hook. Icon. t. 1937 (1890).

DISTRIBUTION.—China: Hupeh; "only found in one dark wood," *A. Henry* 5846 (type)! Without locality, *Wilson* (Arn. Arb. Exped.) 1445! Szechuan: Mt. Omi, fls. yellow, rare, *Wilson* (Veitch Exped.) 4714! Without locality, 1600–2700 m., *Wilson* (Veitch Exped.) 3172!

6. **Corydalis,** *Vent.* Choix. 19 (1803). About 140 species; type: *C. sempervirens*, Pers. (*Fumaria sempervirens*, Linn.).

DISTRIBUTION.—North Temperate Zone; *see* accompanying map.

A monograph* of *Corydalis*, and especially of the numerous Chinese species, is a desideratum. For the Oriental species, *see* Boissier, Fl. Or. i. 126–132 (1867); Indian species, Prain in Journ. As. Soc. Bengal, lxv. 14–41 (1896); North American species, Asa Gray, Synop. Fl. N. Amer. i. 96 (1895).



7. **Roborowskia,** *Batalin* in Act. Hort. Petrop. xiii. 90 (1893).

Roborowskia mira, *Batalin* l.c.

NORTHERN ASIA. Turkestan: Kashgar; Kuen-Lun Mts., northern slopes of Mt. Tahtahon, 3400 m., 19 July 1889, *W. Roborowski.*

I have unfortunately not been able to see a specimen of this remarkable plant, which is described as being woody at the base, and the flower as solitary and scapose without bracts. It is, however, perhaps not distinguishable generically from *Corydalis*, which shows considerable range in habit. Dr. Fedschenko makes no mention of this genus in his numerous papers on the flora of Turkestan.

8. **Phacocapnos,** *Bernh.* in Linnaea, xii. 664 (1838).

Racemes many-flowered; stems not fleshy:

Racemes about 5 cm. long or less; leaf-segments broad - -	1. **P. Cracca.**
Racemes over 10 cm. long, or much longer in fruit; leaf-segments narrow - - - -	2. **P. pruinosus.**

* It is understood that Dr. Fedde is now engaged on this work for Engler's Pflanzenreich.

Racemes 1-few-flowered ; leaf-segments oblong-linear ; stems rather fleshy 3. **P. Burmannii.**

1. **P. Cracca,** *Bernh.* in Linnaea, xii. 664 (1838).
Corydalis Cracca, Schl. in Linnaea, i. 567 (1826) ; Harv. in Harv. & Sond. Fl. Cap. i. 17 (1860).

SOUTH AFRICA. Cape Peninsula : Newlands Woods, *Wolley-Dod* 115 ! Campsbay Hills, *Pappe* ! Paarl : roadsides, *Harvey* ! Uitenhage : Addo, *Zeyher* ! Albany : Blue Krantz, *Burchell* 3637 ! "S. Africa," without definite locality, *Drège* 7586 ! 7587 !

2. **P. pruinosus,** *Bernh.* in Linnaea, xii. 664 (1838).
Corydalis pruinosa, E. Mey. ex Harv. & Sond. Fl. Cap. i. 17 (1860).

SOUTH AFRICA. Clanwilliam : Kloof below Warm Baths, Oliphants River Valley, *E. L. Stevens* (Percy Slad. Mem. Exped.) 7028 ! Cape Peninsula : near Capetown, *Bolus* 4783 ! Uitenhage : Enon, waste places and in the bush, *Drège* ! Graaf Reinet : valleys of Mt. Sneeuwberg, 1100 m., *Bolus* 1964 ! "Orange River," *Burke* ! East Griqualand : scandent on shrubs in the Zuurbergen, *Tyson* 1728 ! Maclear : Tsitsa footpath, eastern slopes of the Drakensberg, *Galpin* 6569 ! Basutoland : Leribe, *Dieterlen* 873 ! Natal : woods at Zwaartskop native location, 1000–1320 m., *Medley Wood* 4597 !

3. **P. Burmannii,** *comb. nov.*

Corydalis Burmannii, Eck. & Zeyh. Enum. no. 23 (1834) ; Harv. in Harv. & Sond. Fl. Cap. i. 17 (1860).

SOUTH AFRICA. Vanrhynsdorp : Eenkokerboom, *Schlechter* 11060 !

9. **Cysticapnos,** *Boerh.* ex Linn. Class. Pl. 181 (1747).

C. africana, *Gaertn.* Frucht. ii. 161. t. 115 (1791) ! Harv. in Harv. & Sond. Fl. Cap. i. 16 (1860).
Corydalis vesicaria, Pers. Syn. ii. 269 (1807).

SOUTH AFRICA. Little Namaqualand : Khamiesberg : between Bitterfontein and Stinkfontein, climber, fls. pale mauve pink, 10 December, 1911, *H. H. W. Pearson* 6556 ! Kharkams, common, 11 December, 1911, *H. H. W. Pearson* 6682 ! Clanwilliam : *Schlechter* ! Sutherland : Little Roggeveld, 26 July, 1811, *Burchell* 1297 ! Cape Peninsula : amongst shrubs on the shores of False Bay, fr. Oct., *Bolus* 2702 ! Battery Point, Hout Bay, fls. & fr. Sept., *Wolley-Dod* 1708 ! Cape Flats, etc., *Ecklon* 21 !

10. **Sarcocapnos,** *DC.* Syst. ii. 129 (1821) (incl. *Aplectrocapnos,* Boiss & Reut.).
Largest petal scarcely spurred at the base ; corolla 5–7 mm. long - 1. **S. baetica.**

Largest petal conspicuously spurred at the base; corolla 1·5–2 cm. long:	
Leaves mostly thin and more or less ovate-acute - - -	2. **S. enneaphylla.**
Leaves mostly thick and more or less reniform-obtuse or emarginate, sometimes entire - -	3. **S. crassifolia.**

For full synonymy of species of **Sarcocapnos** *see* Willkomm & Lange, Fl. Hispan. iii. 886 (1880).

1. **Sarcocapnos baetica,** *Nym.* Consp. 26 (1878).
   DISTRIBUTION.—South Spain: Albacete Prov. to Malaga Prov.

2. **Sarcocapnos enneaphylla,** DC. Syst. ii. 129 (1821).
   DISTRIBUTION.—Eastern Spain: Eastern Pyrenees (Villefranche) to Segovia, south to Almeria Prov.

3. **Sarcocapnos crassifolia,** DC. Syst. ii. 130 (1821).
   DISTRIBUTION.—South-Eastern Spain: Valencia to the Sierra Nevada, and Central Morocco to Oran, Algeria. Type locality: Tlemsen (Algeria). The Spanish plant has been considered a variety (*speciosa*), but the integrity and thickness of the leaves is probably due only to full exposure to the sun.

11. **Adlumia,** *Rafin.* in Med. Repos. New York, v. 352 (1808).
    The inflorescence of this genus is axillary and not leaf-opposed, as described by Bentham & Hooker in the Genera Plantarum.

    Adlumia fungosa, *Greene,* ex *Britton, Stern & Poggenb.* Prel. Cat. 3 (1888); Britt. & Br. Fl. N. St. & Canada, ii. 143, f. 1988.

Fumaria fungosa, Ait. Hort. Kew. iii. 1 (1789).
A. cirrhosa, Raf. l.c. (1808).

DISTRIBUTION.—Eastern Canada to Tennessee and in Corea.
Eastern Canada: "Lake Region and Ontario," *Macoun* 83! Rocky woods, Herly Falls, Seymour, Northumberland Co., very rare, also North Hastings, *Macoun*!
E. United States: Vermont; Charlotte, rich rocky woods, *C. G. Pringle*! Pennsylvania: mountains, *W. Darlington*! *T. Nuttall*! Massachusetts: Taconic Hills, Williamstown, *J. R. Churchill*! Tennessee: mountains above Warmsprings, *Rugel*!
Corea: River Tumin-gan, Musang District, 13 June 1897, *Komarov* 747!

12. **Ceratocapnos,** *Dur.* in Parlat. Giorn. Bot. Ital. i. i. 336 (1844).
Lower indehiscent fruits with 5 straight ribs on each side (as in Fig. 3 C);
Asia Minor - - - 1. **C. palaestina.**

FIG. 3.—*Ceratocapnos heterocarpa*, Dur., showing:
A. The lower 1-seeded indehiscent fruits, and
B. The upper lanceolate bivalved capsules (after Durieu).
C. Lower indehiscent fruit of *Ceratocapnos palaestina*, Boiss.

Lower indehiscent fruits more or less wrinkled (as in Fig. 3 A); N.W. Africa - - - - 2. **C. heterocarpa.**

1. **Ceratocapnos palaestina,** *Boiss.* Diagn. Pl. Or. viii. 12 (1849); Fl. Or. i. 132 (1867); Post, Fl. Syria, Palestine & Sinai, 55 (1896).

PALESTINE: Beirut: *Ehrenberg! Mitchell! Fox!* Road between Saida and Raboutie, *Gaillardot* 53! Nazareth, *Lowne* 350! Magdala, damp shady places, *Meyers & Dinsmore* 8350! Without definite locality, *Boissier! Pinard! Hayne!*

SYRIA: Jerash, *Meyers & Dinsmore* G. 350!

According to Post, l.c., this species flowers from February to May, and is found in hedges and amongst rocks in the Coast range and maritime plains of Syria and Palestine.

2. **Ceratocapnos heterocarpa,** *Dur.* in Parlat. Giorn. Bot. Ital. i. i. 336 (1844).

NORTH-WEST AFRICA. Morocco: Mogador, *Lowe* 171! Mardochee, *Cosson*! in a hedge at Ain-el-Hadjar, *Miss Bainbridge*! Algeria: Oran, near the Spanish Battery, *Kralik* 3a! *Mumby* 17! *Balansa* 622! Mostaganem, *Balansa* 160! near Lalla-Maghnia, *Wariau*! near Cape Carbon, *Cosson*! Hort. *Durieu*!

13. **Trigonocapnos,** *Schlechter* in Engl. Bot. Jahrb. xxvii. 131 (1900).

Trigonocapnos curvipes, *Schlechter*, l.c.

SOUTH AFRICA. Clanwilliam: *Schlechter* 8525 (type)! Near Wupperthal, Koudeberg, 750 m., *Bolus* 8920! Hills at Agtertuin, *Schlechter* 10869!

14. **Rupicapnos,** *Pomel.* Mat. Fl. Atlant. 16 (1860). 20 species; type: *R. corymbosa*, etc. Revision by Pugsley in Journ. Linn. Soc. Bot. xliv. 328 (1919).

DISTRIBUTION.—North Africa, Tunis to Morocco, one species in Andalusia, Spain.

15. **Fumaria,** *Tourn.* ex Linn. Syst. ed. i. (1735).—46 species; type: *Fumaria sempervirens*, L. Revision by Pugsley in Journ. Linn. Soc. Bot. xliv. 233 (1919).

DISTRIBUTION.—Europe, N. Africa, Temperate Asia; elsewhere as weeds of cultivation.

16. **Fumariola,** *Korshinsky* in Bull. Acad. Sci. St. Petersb. ser. v. ix. 403, t. 1 (1898).

Fumariola turkestanica, *Korshinsky*, l.c. 404.

NORTHERN ASIA. Turkestan: Fergana Province; near Liangar, *Korshinsky.*

This is evidently a very remarkable type of the *Fumariaceae*, which I know only from Korshinsky's

description and figure. One might regard it as a primitive representative of the Fumariceae, because the outermost petal is not at all spurred, and the fruit has a curious quadrangular areole at its apex. Korshinsky does not give the altitude on the Thibetan Plateau where the plant was collected, but it is evidently a considerable one.

17. **Platycapnos,** *Bernh.* in Linnaea, viii. 471 (1833); Willk. & Lange, Fl. Hisp. iii. 885 (1880), which see for further synonymy.

Leaf-bases not persistent at the base of the stems; flowering stems leafy; bracts lanceolate, acuminate -	1. **P. spicatus.**
Leaf bases persistent at the base of the stems; flowering stems leafless or nearly so; bracts ovate - -	2. **P. saxicola.**

1. **P. spicatus,** *Bernh.* l.c. (type species); Willk. & Lange, l.c. *P. Echeandiae,* Pau, Not. Bot. Fl. Espan. ii. 6 (1889).

DISTRIBUTION.—Mediterranean (up to 1300 m.) from Portugal eastwards to Italy, and in North Africa and Canaries.

2. **P. saxicola,** *Willk.* in Bot. Zeit. 1848, 367; Willk. & Lange, l.c.

DISTRIBUTION.—South Spain: Huescar Province at high altitudes (2000–2300 m.) in the Sierra Sagra. Morocco: Djebel Ghat, Demnat Province.

I have not seen the following species, which are, perhaps, doubtfully distinct from *P. spicatus* :—

Platycapnos tenuilobus, *Pomel* Fl. Atlant. 240 (1874); Algeria; Garrouban, Mazis.

Platycapnos grandiflorus, *Rouy.* in Rev. Sc. Nat. Ser. iii. i. 66 (1883); Spain.

18. **Discocapnos,** *Cham. & Schlecht.* in Linnaea, i. 569 (1826); Harv. in Harv. & Sond. Fl. Cap. i. 18 (1860).

1. **Discocapnos Mundtii,** *Cham. & Schlecht.* l.c.; Harv. l.c., excl. var. *Dregei,* Harv.; Harv. Thes. t. 10.

SOUTH AFRICA. Cape Division: Hills around Cape Town, *Mundt & Maire.* Platteklip, *Pappe*! Devils Mt., *Ecklon* 24! near Rondebosch, *H. Bolus* 4797! Newlands Woods, fl. & fr., Aug. *Wolley Dod* 114! "Cape," *Harvey*!

2. **Discocapnos Dregei,** *Hutchinson,* sp. nov.; a *D. Mundtii,* Cham. et Schlecht., foliorum segmentis angustioribus, racemis multifloris gracilibus, fructibus minoribus minute et parce puberulis elliptico-rotundatis alis angustissimis differt. *Discocapnos Mundtii,* var. *Dregei,* Harv. l.c. *Fumaria scandens,* Drège, Zwei Pfl. Docum. 125, *nomen.*

SOUTH AFRICA. Knysna Division: Bosch River, between the "Bush" and the river, below 140 m., fl. & fr., Oct., *Drège*!

X.—RAVISON AS A COMMERCIAL TERM.

L. A. BOODLE.

Though the word "Ravison" has been introduced into England from France, it is not to be found in Littré's Dictionnaire de la Langue Française, and therefore appears not to be recognised among the current French names of plants.

Rolland (Flore Populaire, 1899) gives numerous popular names applied to species of *Brassica* and *Sinapis* in France. Of these, ravasson and ravoss' show the nearest approach to the word ravison, and both are used to designate *Sinapis arvensis*, L. (Charlock). Rolland notes, by way of authority, that he met with the name ravasson in Corbigny, and ravoss' in Chambéry, the use of both words depending on oral tradition. This localisation suggests that the employment of these names may be somewhat restricted.

Several Italian words cited by Rolland are apparently related to "ravison." Three of these, ravizzone ravissòn* and raviscion, are placed under *Brassica Napus* (var. *sylvestris*), by which *Brassica campestris* var. *autumnalis*, DC. (*B. Rapa* var. *oleifera*, DC., *i.e.*, Winterrübsen, sometimes called Wild Turnip or German Rape) is presumably intended.† Ravizzone is listed as an Italian word,‡ while ravissòn and raviscion are quoted as belonging to the Genoese and Milanese dialects respectively.

For *Brassica Napus* var. *oleifera*, DC.§ (Rape), the following are among the Italian names quoted by Rolland:—ravizzioni (Italian, 1805), raviscion and ravizzon (Milanese), ravizon (Treviso), ravazzon (Verona), ravizzon and ravizze (Friuli). Further, under *B. campestris* (L.) ravissun (Piedmont) is cited. All these appear like variants of the same word, and it is to be noted that in the Milanese dialect precisely the same word (raviscion) is applied to varieties of both *B. Rapa* and *B. Napus*. It is probable that some of these names are used loosely, for instance for rape or for other plants resembling it.

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* Rolland writes this word with a circumflex over the last vowel, but the orthography should probably be ravissòn.

† Among the names Rolland gives for *B. Napus* (var. *sylvestris*) are:—navette and navette dauphinoise (French), Rübsen and Rübsat (*i.e.*, Rübsaat; German).

‡ Ravizzone appears also in the following Dictionaries:—Targioni Tozzetti, Diz. Bot. Ital., 1825; Cuzzuola, Diz. di Bot., 1876; Davenport and Baretti's Ital. Dic. The meanings given are:—(1) *Brassica Napus, sylvestris*; (2) *B. Napus*, L. (3) a variety of cabbage.

§ Written by Rolland:—*Brassica Napus* (L.) var. *oleifera*; and made a synonym of *B. Napus* var. *biennis*, Reichb. in Engler's Pflanzenreich.

The word ravison, as a commercial term applied to oil-seed in England, appears to be subject to considerable elasticity of employment. Simmonds (Handbook of British Commerce, 1898) defines ravisons as the French name for rape seed, while Laucks (Commercial Oils, 1919, p. 57), in writing of rape-oil, mentions that allied seeds, such as ravison and mustard, sometimes are mixed unavoidably with rape-seed. Here ravison does not signify rape, but evidently implies the seeds of certain other plants growing among a crop of rape. Bolton and Revis (Fatty Foods, 1913, p. 212) state that ravison oil is derived from the seeds of a wild variety of *Brassica campestris* from the Black Sea district. A sample of seed in the Museum at Kew, received under the name of Black Sea Wild Rape, may be classed as ravison, and is probably the type of seed intended in the above quotation from Bolton and Revis. The sample has been found to consist chiefly of Charlock (*Sinapis arvensis*, L.) together with some "Sarepta Mustard" and other seeds.

A letter received last year by the Director of the Royal Botanic Gardens, Kew, from Prof. D. Bois, gives the information that in France the name Ravison is used to denote the seeds of different species of *Sinapis* imported into Marseilles and other ports, oil being extracted from the seeds and employed for different purposes, notably for the manufacture of soap. Prof. Bois adds that these seeds come principally from the Orient, and that they apparently consist chiefly of *Sinapis arvensis*, *S. dissecta*, *S. juncea*, &c. A particular region of the Orient is indicated by the mention of *Sinapis dissecta*, which is cultivated in South Russia, and is often found in considerable quantity in "rape-cake" of Russian origin.* The *S. juncea* referred to by Prof. Bois may therefore be described as "Sarepta Mustard," this name being given to a species of *Brassica*, which is cultivated in Southern Russia, and is described either as *B. Besseriana*, Andrz. or *B. juncea*, L. The first of these two names appears in Engler's Pflanzenreich (Heft 70; iv. 105, p. 55) as a synonym of *B. juncea* (L.) Czern. et Coss. (Chinese and Indian Mustard). It may be mentioned here however that Kinzel (loc. cit., p. 184) retained the name *B. Besseriana* for Russian Sarepta Mustard, holding the latter to be distinct from *B. juncea*, and noted that the mucilaginous epidermis of the seed showed distinct cellular structure, a character which he did not find in any of the forms of Indian Mustard (*B. juncea*) examined by him.†

The use of the word ravison in France, as explained by Prof. Bois, is thus not confined to the seed of a single species of *Brassica* (incl. *Sinapis*), but is applied rather to a mixture of seeds, of which Charlock may be one, and "Sarepta Mustard" another. "Black Sea Wild Rape," being of similar composition.

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* Kinzel, Landw. Versuchs-Stationen, vol. 52 (1899), p. 185.

† This difference was verified in the case of two samples in the Kew Museum, namely seeds of "Sarepta Mustard" from Black Sea Wild Rape, and seeds of *B. juncea* from Dharwar, India.

may be described as ravison, and moreover proved to agree well in its constituents with a sample of ravison with which it was compared.

Some information concerning ravison is contained in an article by Rothéa,* who remarks that in certain countries, such as Southern Russia and the Danubian Provinces, Charlock is specially harvested, and is even the object of an important culture, the seed arriving in France under the name of ravison. He adds that, in the exotic countries which produce it, ravison is generally harvested with very little care, and contains a great variety of foreign seeds. One may, therefore, say that in ravison as imported into France, Charlock is the crop-seed, and that the other components are accidentally present as weed-seeds. Rothéa proposes to apply the name ravison also to seed of Charlock gathered in France, where however it is very rarely harvested.

Rothéa gives chemical analyses of ravison and of oil-cake obtained from the seed, refers to cases of intestinal irritation occurring among animals fed with the cake, and describes some table-mustard prepared from the seed as resembling that made from the seed of White Mustard.

It is interesting to note that, though ravison is imported into Marseilles, etc., for the extraction of a commercial oil, the stipulation is sometimes made by crushers in Antwerp that oil-seed supplied to them shall be free of ravison. The explanation apparently depends on the particular use to which the oil is to be put.† Thus Bolton and Revis (loc. cit., p. 212) state that ravison-oil forms an adulterant of rape-oil, and that its uses are practically those of rape-oil, but that it is not so suitable for lubricating purposes.

To return to linguistic matters, the fact that ravissôn is a Genoese word, and is practically the same as the French name ravison, may possibly have some significance, Genoa being, perhaps, in some cases a port of trans-shipment for Black Sea produce on its way Westward to France. Though ravissòn is applied to *B. Rapa* var. *oleifera*, DC., it may, perhaps, be used also as a commercial term for oil-seeds of more than one kind, in a similar way to "rape" in its extended sense.

Assuming that some imported ravison may occasionally have been sown as a crop in France, the local application of the word ravasson to Charlock (mentioned by Rolland, and quoted above) might be explained, since Charlock would presumably prove to be the predominant plant in the crop, ravasson, on this supposition, being regarded as a variant of ravison.

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* Rothéa, La graine de moutarde des champs ou ravison, et les produits qui en dérivent. Bull. des Sciences Pharmacologiques, vol. 26 (1919), pp. 16–20. References to two earlier papers by other authors dealing with the seed and cake of ravison are given.

† Or, perhaps, in some cases the stipulation referred to might depend on the intended use of the oil-cake as cattle-food.

XI.—DECADES KEWENSES.

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS CII.

1011. **Berberis pseudumbellata,** *Parker* [Berberidaceae-Berbereae]; *B. virescenti*, Hook. f., affinis, sed fructu obovoideo vel subgloboso atro-coeruleo distincta.

Frutex 2 m. altus, ramulis gracilibus subangulatis glabris; spinae 1–3-fidae. *Folia* oblanceolata vel spathulata, apice rotundata, basi in petiolum attenuata, 1·5–3 cm. longa, integra vel brevispinoso-serrata, membranacea, subtus pallidiora, obscure papillosa; petiolus 0·3–1 cm. longus. *Racemi* subcorymbosi, 3–5 flori; pedunculi 0·5–1·5 cm. longi. *Flores* pallidi, flavi; pedicelli 0·6–1·2 cm. longi. *Sepala* externa elliptica, 3 mm. longa. *Petala* obovata, basi nectariis duobus instructa, 6 mm. longa. *Stamina* ovarium aequantia. *Ovarium* 3-ovulatum; stylus brevissimus. *Fructus* obovoideus, deinde subglobosus, pruinosus, 1 cm. longus; stylus subnullus; stigma magnum. *Semina* 1–3. *B. vulgaris* var. *brachybotrys*, Hook. f. et Thoms., Fl. Ind. i., 220 ex parte, non *B. brachybotrys*, Edgew. *B. orthobotrys*, C. K. Schneider in Bull. Herb. Boiss. sér. 2, v, 662 ex parte, non Bienert in Herb. Bunge.

India. N.W. Himalaya, 2400 m., Ulansa, Ravi Valley, Chamba State, 17.8.1920 (fruit) and 3.5.1920 (flowers), *R. N. Parker*.

The following sheets in Herb. Kew. belong to this species: Kashmir; 3500 ft. and 5300 ft., *Thomson*; Herb. *Falconer* 98; *Hunter-Weston* 10158; *Clarke* 24214: Simla; Narkanda, *Brandis*.

This species is common in the Kagan Valley, Hazara; Bharmaor and Pangi, Chamba; Lahul and Kunawar.

1012. **Wercklea lutea,** *Rolfe* [Malvaceae-Hibisceae]; a *W. insigni*, Pitt. & Standl., pedicellis pubescentibus, calycis lobis latioribus et floribus luteis differt.

Arbor 5–6·5 m. alta. *Ramuli*, petioli et pedunculi dense stellato-pubescentes. *Folia* longe petiolata; limbus cordato-suborbicularis, repando-undulatus, subcoriaceus, 7-nervis, distanter denticulatus, 15–20 cm. longus, 17–23 cm. latus, subtus dense stellato-pubescens, supra sparse stellato-pubescens; petioli 10–12 cm. longi. *Pedunculi* solitarii, 7–13 cm. longi. *Flores* magni. *Involucra* cupulata, 2–3-loba, 3 cm. longa; lobi ovati, subacuti, concavi, stellato-pubescentes. *Calyx* campanulatus, 4 cm. longus, breviter 5-lobus, dense hirsutus; lobi triangulari-ovati, subobtusi, circiter 1 cm. longi. *Corolla* 10–11 cm. longa, anguste campanulata; petala spathulato-obovata, lutea. *Columna* staminalis circiter 8 cm. longa; antherae numerosae, oblongae. *Stigmata* capitata. *Capsula* 5-angulata, 5–6 cm. longa, sublignosa, longe

hirsuta ; semina numerosa, ellipsoidea, subcurvata, longe hisruta, circiter 4 mm. longa.

Costa Rica. Las Nutes, Cascajal River, 2100 m., *C. H. Lankester.*

Mr. Lankester, who brought home both flowering and fruiting specimens, remarks that this tree occurs sparingly along the ravine of the Cascajal River, and in some of the ravines just beyond his Cascajal farm. It bears a general resemblance to the original *W. insignis* (of which ample materials were also collected at Cascajal), but it is of somewhat smaller stature, and the flowers do not open so widely, while the petals are lemon yellow or bright canary yellow instead of lilac rose. The genus is at present only known from Costa Rica.

1013. **Cotoneaster obovata,** *Wall. MS.* in Herb. propr. *ex Dunn* [Rosaceae-Pomeae], a *C. rosea*, Edgew., foliis ellipticis obtusis subtus persistenter tomentosis differt.

Frutex deciduus, ad 3 cm. altus. *Caules* longe arcuantes, superne paullo ramosi ; cortex rubescens, tandem griseus. *Folia* exacte elliptica, apice basique obtusa, ad 10 cm. longa, 7 cm. lata, chartacea, supra mox glabra, subtus ut ramuli novelli, petioli, pedicelli, calyces, petalorum bases et ovaria dense griseo- vel albo-tomentosi. *Flores* 1 cm. diametro rubidi. *Calycis* tubus intra glaber, 3 mm. longus ; lobi 2 mm. longi, acuminati. *Petala* spathulata, 3 mm. longa, erecta vel patula. *Stamina* 18–20. *Ovaria* 2. *Poma* pyriformis, tandem rubra, 8 mm. diam.

India. N.E. Punjab : Kangra, Chandaghery, *Wallich* ; Chamba from 2300–3700 m., common in the Urnu, Pontu, Kagal, Rangi, Chota and Bara Bambal forest reserves. Flowers in June and July, fruit in December. *Ellis* 75, 1192 ; *Parker* 18–23.

Mr. Parker writes that it is a plant of forest undergrowth, affecting (for Pangi) rather moist places. It usually sends up a simple stem, which gets pressed down by the snow, a fresh shoot taking its place. Occasionally on rocky ground it forms a small thicket 2–3 ft. high. Large, flowering plants are rare. The petals at low elevations are usually spreading, but higher up are upright.

1014. **Spiraea hypoleuca,** *Dunn* [Rosaceae-Spiraceae] ; *S. hypericifoliae*, Lam., affinis, sed foliis apice saepius 3-lobatis subtus albis, pedicellis bracteisque sericeis differt.

Frutex parvus, ramosus, ramis longis gracilibus striatis, cortice rubro. *Folia* obovato-lanceolata, apice saepius paucidentata vel trilobata, basi cuneata, 15–20 cm. longa, mox glabra, subtus alba, papyracea, plana ; petioli ad 8 mm. longi. *Flores* albi, 7–8 mm. diametro ; pedicelli graciles, 10–15 cm. longi, ut bracteae et bracteolae caducae calycesque primo sparse sericei, plurimi in nodis approximatis fasciculati, nonnunquam parce ramosi et ita corymbos formantes. *Calyx* urceolatus, 2 mm. longus ; dentes breves, obtusi. *Petala* spathulata, 2·5 mm. longa, patula. *Stamina* indefinita. *Ovaria* 6–8, sparse sericea. *Carpella* 4–5, fere glabra.

India. Garhwal: rocks in Dombitia Gadh, 2300–3000 m., *Duthie* 3965; Kanol, *Osmaston* 1064 (in part), 1065.

1015. **Ducrosia ovatiloba,** *Dunn et R. Williams* [Umbelliferae-Peucedaneae] a *D. anethifolia*, Boiss., laciniis ovatis, umbellae radiis 3–5 distincta.

Herba perennis (?), gracilis, 30–40 cm. alta, superne nuda, omnino minute puberula. *Caulis* striatus. *Folia* pinnatim triternata, ambitu rotundato-ovata, ad 10 cm. longa; petiolus 5 cm. longus, basi breviter vaginatus; segmentorum laciniae ovatae, trilobae, apice rotundatae, 1–2 cm. longae, paucicrenatae, laterales sessiles, terminales rotundatae, petiolulis 1 cm. longis. *Umbellae* in paniculam dispositae, longe pedunculatae, bracteis paucis parvis linearibus; umbellulae 3–5, radiis 2–3 cm. longis suffultae, multiflorae, bracteolis pluribus parvis linearibus. *Flores* 2 mm. lati. *Petala* obovata, integra, cum lacinula inflexa. *Fructus* a dorso plano-compressus, margine tumido laevi semini contiguo cinctus. *Mericarpia* jugis 5 tenuiter filiformibus aequidistantibus, lateralibus margini dilatato contiguis. *Semen* planum. *Vittae* in valleculis solitariae, comissurales binae, arcuatae. margini contiguae.

India. Chitral: Ziarat; 2000 m. July 1908, *Toppin* 452. *Ducrosia* as previously known, consisted of one species limited to Persia and the immediate surroundings of that country. Four species have indeed received the same generic name but *D. flabellifolia*, Boiss. of which mature fruit is not known is probably not a *Ducrosia* at all and *D. Ismaëlis*, Aschers, certainly not. *D. Olivieri*, Boiss. (reduced by its author to his *D. anethifolia*) and some other forms comprised a fairly uniform group under the latter name; but it will possibly be broken up into three or four species when more material is available. The present example while agreeing perfectly in its fruit, is aberrant in the other characters enumerated above. It therefore amplifies the limits of *Ducrosia* as previously defined both morphologically and geographically.

1016. **Emilia ramulosa,** *Gamble* [Compositae-Senecionideae]; species capitulis solitariis longe pedunculatis, foliis linearioblongis vel spathulatis vix auriculatis subtus lanugine crispato-hirsuto tectis insignis.

Suffrutex humilis, ramulosus, ramulis gracilibus aliquando longissimis. *Folia* lineari-oblonga vel spathulata, apice obtusa, basi attenuata non vel aliquando brevissime auriculata, marginibus integris vel leviter sinuatis recurvis, supra glabra, subtus lanugine crispato-hirsuto tecta, 2–7 cm. longa, 1–1·5 cm. lata, nervis obscuris; petiolus brevissimus vel nullus. *Capitula* solitaria, longe pedunculata, ad 1·5 cm. longa et lata, multiflora. *Bracteae* 7–8, oblongae, glabrae, 1 cm. longae; bracteolae nullae. *Receptaculum* nudum. *Corollae* infundibulares, 4 mm. longae; lobi anguste lineares, 3 mm. longi, apice brevissime puberuli. *Styli* rami teretes, apice dilatati, puberuli. *Achaenia* 5-angulata, 3 mm

longa, oblonga, ad angulos brevissime scabra ; pappus brevis, albus, sericeus.

South India. Attraymallay hills : Travancore ; 1580 m., *R. H. Beddome* (*Herb. Madr.*) ; Agastiamalai, Tinnevelly, May 1901, *C. A. Barber* 2930 ; Kalivayalpil, Tinnevelly, June 1901, *C. A. Barber* 3053.

1017. **Ardisia Blatteri,** *Gamble* [Myrsinaceae Eumyrsineae] ; *A. pauciflorae,* Heyne, et *A. rhomboideae,* Wight, affinis, foliis eximie nervosis marginibus conspicue crenato-serratis insignis.

Frutex erectus, ramulis teretibus, ultimis ferrugineo-villosis. *Folia* elliptico-lanceolata vel oblanceolata, chartacea, punctata, apice caudato-acuminata, basi longe et cuneatim attenuata et in petioli margines decurrentia, margine crenato-serrata, 6–10 cm. longa, 2–3·5 cm. lata ; costa conspicua, supra profunde impressa ; nervi utrinque 10–20, irregulares, conspicui, supra impressi, marginem versus arcuatim juncti et nervulis multis intermediis aucti ; petiolus circiter 1 cm. longus, alatus. *Cymae* axillares, subumbellatae, ad 3 cm. longae, ferrugineo-villosae ; pedunculus gracilis, 2 cm. longus ; pedicelli graciles, brevissimi ; bracteae et bracteolae subulatae. *Calycis* lobi minimi, patentes, nigro-punctati et margine glandulosi. *Corollae* lobi ovati, acuti, rosei, eximie nigro-punctati, 3 mm. longi. *Antherae* ovatae, acuminatae, dorso nigro-punctatae. *Stylus* gracilis, subulatus, persistens. *Bacca* globosa, nigra, glabra, 4–5 mm. diametro.

S. India. Madura District : "High Wavy Mountain" : near Cumbum, May 1917, 1300–1700 m., *Blatter and Hallberg* 3, 251, 552, 564. Hills of Travancore in moist forests, 700–1300 m., *T. F. Bourdillon,* February 1887, "a shrub 15–20 ft. high, 4–6 in. in diameter" ; *T. F. Bourdillon* 14 is probably the same species, but the leaf-nervation is less conspicuous.

1018. **Bassia Bourdillonii,** *Gamble* [Sapotaceae] ; species decidua, floribus subterminalibus fulvo-tomentosis, foliis longis membranaceis oblanceolatis brevissime petiolatis ad apices ramulorum conspicue confertis insignis.

Arbor mediocris, decidua, ad 20 m. alta, 40–50 cm. trunci diametro, ramulis rugosis crassissimis. *Folia* membranacea, ad apices ramulorum densissime conferta, oblanceolata, apice acuta, basi in petiolum attenuata, supra glabra, subtus (et aliquando juventute supra) ad costam et nervos fulvo-lanata, 20–30 cm. longa, 6–10 cm. lata ; costa crassa, supra impressa ; nervi primarii utrinque 20–25, primum recti, deinde prope marginem curvati, nervulis transversis et reticulatione inconspicuis ; petiolus ad 1 cm. longus, crassus, dense fulvo-tomentosus. *Flores* pedicellati, ad apices ramulorum conferti, bracteis brevissimis lanceolatis suffulti ; pedicelli fulvo-tomentosi, circiter 2 cm. longi, patentes vel haud conspicue nutantes. *Calycis lobi* ovati, acuti, fulvo-tomentosi, 7–10 mm. longi. *Corollae* tubus carnosus, 5 mm. longus, glaber ; lobi 12, oblanceolati, 7 mm. longi, lutescentes. *Stamina* circiter 24 ; antherae glabrae, basi cordatae, longe

apiculatae. *Ovarium* ovoideum, fulvo-villosum, stylo crasso longissimo. *Fructus* (teste *Bourdillon*) ovoideus, viridis, 3–4 cm. longus. *B. fulva*, Bourdillon, Forest Trees of Travancore, p. 238, *not of* Bedd.

S. India. Evergreen forests of South Travancore: in the Ariankavu and Shendurni valleys; about 300 m. *T. F. Bourdillon* 386, 533, 842.

1019. **Teucrium Toppinii,** *Dunn et R. Williams* [Labiatae-Ajugoideae] a *T. Stocksiano*, Boiss., floribus majoribus et bracteis foliaceis multis differt.

Suffrutex; caulis ramosus, 20 cm. altus, ut folia bracteaeque breviter canescenti-velutinus. *Folia* sessilia, obovata, basi cuneato-attenuata, 1·2–1·5 cm. longa, fere 1 cm. lata, in dimidio superiore conspicue crenata. *Verticillastri* pauci, multiflori, in capitula terminalia bracteis involucrata conferti; bracteae multae, crenatae; bracteolae integrae, ut calyces laxe hirtae. *Calyx* tubuloso-campanulatus, 10-nervis, 5-dentatus; dentes subaequales, apice paullo denticulati. *Corolla* luteola; tubus calyci aequilongus, 8 mm. longus; limbus unilabiatus; labium superius nullum; inferius 5-lobum, nervis purpureis notatum, 8 mm. longum et latum. *Stamina* e tubo longe exserta; filamenta ad corollae faucem adnata. *Stylus* bifidus.

N.W. India. Chitral, *Toppin* 313. The section *Polium* to which this species belongs, has hitherto not been found to occur further north in India than Peshawar.

1020. **Dracocephalum glechomifolium,** *Dunn*, [Labiatae-Nepeteae] a *D. imberbi*, Bunge, capitulis laxe lanatis haud involucratis, corollis decurvatis differt.

Herba ascendens, circiter 30 cm. alta, breviter ramosa, supra densius, infra laxius lanata. *Folia* caulina late ovata, 1·5–2 cm. longa, apice rotundata, basi subcordata, in petiolum aequilongum subito attenuata, regulariter crebreque crenata, utrinque conspicue nervosa, pauciglandulosa. *Verticillastri* 6–10-flori, 2–4 in spicam globosam terminalem 5–7 cm. diametro congesti, nonnunquam uno paullo distante; bracteae bracteolaeque lineari-lanceolatae vel lineares, membranaceo-marginatae. *Flores* 1·8–2·3 cm. longi. *Calyx* tubulosus, bilabiatus, 1 cm. longus, pallidus, nervis 15 viridibus ornatus; labii superi dentes 3 anguste triangulares, 3 mm. longi, inferi similes, vix ad sinus superiorum attingentes. *Corolla* luteola, ut calyx albo-hirta; tubus exsertus, inferne anguste tubulosus, superne ampliatus, fauce nudus; labia hiantia, superum oblongum, erectum, bilobum, 3 mm. longum, inferum late ovatum, trilobum, 4 mm. longum, medio hirtum, basi in sinu utroque recurvum. *Stamina* 4, sub labio supero inclusa, 2 superioria altera excedentia. *Stylus* bifidus. *Nuculae* maturae non visae.

N.W. India. Chitral: Madaglast; 4200–4500 m., *Toppin* 564.

XII.—MISCELLANEOUS NOTES.

James Ramsay Drummond.—We regret to announce the death of Mr. James Ramsay Drummond, B.A., F.L.S., late of the Indian Civil Service, at 119, Twyford Avenue, North Acton, on the 11th of March.

Mr. Drummond was born in Scotland on the 13th May, 1851. He was educated at Edinburgh, Glasgow, and New College, Oxford, and appointed to the Indian Civil Service in 1872, but he joined it only in 1874. He served in the Punjab as Assistant Commissioner, District Judge and Deputy Commissioner until his retirement in 1905. Shortly before his retirement he was acting for the Curator of the Herbarium, Royal Botanic Garden, Calcutta, during his absence. He made extensive collections in the Western Punjab, whose flora he knew very intimately, and only to a lesser extent in the neighbourhood of Dalhousie and Simla and in the Gangetic Plain. After his return to England he settled at Kew devoting most of his time to the working out of his collections and the preparation of a Flora of the Punjab, which he had undertaken to write. Ill-health interfered much with the progress of the work which never got beyond the initial stage. A few years ago he moved to Acton, where he died rather unexpectedly.

J. R. Drummond was a man of unusual versatility and unbounded enthusiasm for botany, in the field as well as in the herbarium. He was endowed with a remarkable memory and decided linguistic gifts, and possessed a many-sided knowledge, which he was always ready to place at the disposal of his friends and fellow workers. Practically all his publications fall into the time after his retirement. They are not numerous and consist mainly of descriptions of new plants, among them the new genus *Chamydites* (Compositae), and critical notes on "Grewias of Roxburgh," in this Bulletin (1911). An extensive paper published (with Prain) in the Land Records and Agriculture, Bengal, 1905, and reprinted in the Agricultural Ledger, 1906, was devoted to the Agaves and Furcroyas of India. In connection with his studies in the latter genus he also produced "Literature of *Furcraeae*, with a synopsis of the known species" which appeared in the Report of the Missouri Botanic Garden for 1907.

Robert Allen Rolfe.—In the Kew Report for 1880 Sir J. D. Hooker, referring to the Herbarium, wrote:—"Mr. R. A. Rolfe, an advanced gardener in the Royal Gardens, was appointed Second Assistant . . . after a public competition, conducted by the Civil Service Commission." Rather more than forty years have elapsed since that announcement was made. Both the author and the subject of it have been removed by the hand of death. The young gardener, mainly dependent on his own ability, industry, and perseverance, became in course of

time a botanist of distinction and the recognised authority of his day and of his country on the large and interesting family *Orchidaceae*. Mr. Rolfe arrived at the age of retirement last May, but though then 65 he seemed to be as vigorous and active as many a man considerably younger. In order that he might apply himself to some special work on his favourite group, an extension of service for one year was granted. There was good reason to hope that for many years to come, after his indefatigable official career was ended, he would be able to pursue the studies to which he had already devoted the best part of his life. However, at Christmastide last year his health suddenly failed, and after many weeks of illness, due it was eventually ascertained to a cerebral tumour, he passed away on April 13th, to the great grief of his family and friends. On April 18th, in the presence of a company which included many of the permanent Kew staff, he was laid to rest in Richmond Cemetery. Thus we have had the sad experience—the first of its kind in the history of Kew since the time of Sir William Hooker—of losing by death an old member of the established staff while still on active service. Many civil servants engaged in scientific or literary work anticipate retirement as an opportunity for undertaking or continuing some investigation or study which the pressure of official duties and routine had not permitted. Their leisure is spent in activities that have resulted in numerous valuable contributions to knowledge. Not a few of these contributions have come from Kew men in retirement, which happily in so many instances has been prolonged. We could expect from our knowledge of Mr. Rolfe's habits and character that, had his life and health been spared, he would have attempted and achieved during the next few years a great amount of useful work. While deeply indebted to him for his many and distinguished services, and deploring the loss of the rich store of special information he had acquired, we have great cause for regret in being deprived of further fruits of his labours. This year he had contemplated a journey to Central America, mainly in the interests of orchidology, and a grant in aid had actually been voted by the Government Grant Board of the Royal Society. A visit to Vienna had also been projected, the purpose of which was to consult Reichenbach's Herbarium preserved in the Hofmuseum. The twenty-five years during which the collections comprising that Herbarium were to remain sealed up, as directed by Reichenbach in his will, terminated on May 5th, 1914. The war intervening it had not been possible for Rolfe to go to Vienna as soon as the collections were accessible, but detailed preparations had been made for the visit.

Robert Allen Rolfe was born at Ruddington, a village near Nottingham, on May 12th, 1855. He first came to Kew on April 7th, 1879, after spending some time in the Duke of Portland's famous gardens at Welbeck Abbey, Notts. He had a predilection for botany, and won the post in the Herbarium after an examina-

tion in which nine contested. His first published paper was on oak-galls, which he had observed in the Kew Arboretum. This appeared in the Entomologist for 1881, and was continued in the volume for 1883. So far as we have ascertained his earliest contribution to orchidology was a "Revision of the genus *Phalaenopsis*," which was published in the *Gardeners' Chronicle*, 1886, vol. xxvi. At that time we had no living English authority on the *Orchidaceae*. Lindley had been dead many years. The considerable work of identifying old species and describing new ones—and at a period too when it might be said that the cultivation of orchids had become a craze—was to a large extent in the hands of Prof. H. G. Reichenbach of Hamburg. He spent much time in this country and was in close touch with our orchid importers and cultivators, who made a practice of appealing to him for botanical assistance. In 1889 Reichenbach died, and the state of feeling that must have been produced when it was known he had disposed of his Herbarium can be more easily imagined than described. Intentionally or not a severe blow had been struck at Rolfe, who in the few years immediately preceding Reichenbach's death had taken much interest in orchids and had published several papers on them, besides the Revision above mentioned. The situation and how it was met is admirably explained in the *Kew Bulletin*, 1891, p. 193. Rolfe speedily became the English expert in orchidology, and a respected and trusted authority everywhere. During the quarter of a century in which Reichenbach's many types, often themselves the only existing clues that could be relied on for determining what he meant by his species, Rolfe and other botanists have described a great number of orchids supposed to be new. An examination of Reichenbach's Herbarium will, no doubt, reveal the fact that some of them were not new, but had been described and published in some fashion by Reichenbach himself; therefore, it is probable that many names which have become well-known will, in observance of the law of priority, have to be relegated to synonymy.

Rolfe's contributions to the literature of botany and particularly to that of the *Orchidaceae* have been very numerous and valuable. Within a few days of his death the 48th decade of his diagnoses of new orchids appeared in the *Kew Bulletin*. He elaborated the *Orchidaceae* for the Flora of Tropical Africa and the Flora Capensis (excepting the tropical Brownleeas and Disas, which were dealt with by Mr. N. E. Brown) and for the Index Florae Sinensis. He published many papers on the family in the *Kew Bulletin*, the Journal of the Linnean Society, the *Gardeners' Chronicle*, and in other periodicals; and all the descriptions of species in the Botanical Magazine since 1905, and a few before that year, were by him. He assisted the late Mr. Sander of St. Albans with the two volumes of the second series of the magnificent "Reichenbachia"; edited for some years the English edition of "Lindenia," and in 1893 founded

The Orchid Review. This periodical, which must have proved a great boon to orchidologists, appeared continuously till the close of last year, and has therefore a longer history than any other of its kind. He edited and to a large extent wrote the twenty-eight annual volumes published. The work connected with *The Orchid Review* and much of a like character, performed in the intervals between official hours, must have taxed him to a degree that very little time could have remained for other interests or for recreation. He had valuable help in preparing *The Orchid Review* for the press and in distributing it on publication from Mrs. Rolfe and his daughter.

Rolfe's work was by no means limited to the *Orchidaceae*. He investigated many widely different groups of plants, and his interest in plant-galls, especially those of the oak, persisted to the end. The families *Myoporinaceae* and *Selaginaceae* as well as the *Orchidaceae*, were prepared by him for the African Floras, and he paid some attention to the *Rosaceae*, more particularly to the genera *Rosa* and *Rubus*. During the first few years in the Herbarium he collaborated with Vidal in determining the large collections made by Cuming and by Vidal himself in the Philippine Islands. More recently he spent much time on the material which arrived, in almost embarrassing profusion, from the same islands, and on F. C. Lehmann's collection from Colombia and Ecuador. Preparing matter for publication, though an important, is a relatively small part of the work of the Herbarium Staff. Rolfe had a liberal share of the routine duties to attend to, and on every side we find the trace of his hand. He was extremely careful as to details; an identification attributable to him may, as a rule, be trusted.

The problems connected with the hybridisation of plants proved alluring to Rolfe, and he devoted much careful study to them. He took part in the conferences on hybrids organised by the Royal Horticultural Society in 1899 and 1906, and with Mr. C. C. Hurst produced in 1909 "The Orchid Stud Book: an enumeration of hybrid orchids of artificial origin,"—a most painstaking work. He acted as judge at the Ghent Quinquennial Exhibitions of 1898, 1903 and 1908, and at the Florence International Exhibition of 1911.

Rolfe was elected an Associate of the Linnean Society in 1885 and an Honorary Fellow and Member of the Scientific Committee of the Royal Horticultural Society in 1906. From the last-named Society he received the Victoria Medal as recently as February last; about the same time he was also awarded the Gold Medal of the Veitch Memorial Trust Fund, and in 1917 the Medal of L'Académie Internationale de Botanique.

Portraits of Rolfe have been published in the *Gardeners' Chronicle* of February 12th and April 23rd, 1921 (the same portrait in both issues), and in the Journal of the Kew Guild, 1911–12. Naturally several species of orchids and other plants have been named in compliment to him; also the genera *Rolfea*, Zahlbruckner, an orchid from British Guinea, which Rolfe had

himself called *Jenmania*, a name already used for a genus of lichens, and *Allenrolfea*, O. Kuntze (= *Spirostachis*, S. Wats.), of the family *Chenopodiaceae*.

Partial deafness of long standing was no doubt answerable for an attitude of reserve and detachment which was more or less characteristic of Rolfe; to some extent he possibly derived advantage from this affliction, for he seemed to be able to proceed tranquilly with his work in circumstances that would have caused serious interruption to others. Though precluded by his official position and the many duties belonging to it from taking an active part in local affairs, he was always interested in them, and he held very pronounced political views. He had a liking for music and for many years was a member of the choir of St. Luke's Church, Kew Gardens. He married in 1881 Miss Caroline Berkeley Thatcher, the eldest daughter of Mr. W. Thatcher of Clifton and Cheddar. Mrs. Rolfe survives, with one daughter and three sons. The success of his life is in no small measure due to the happiness of his home. He was an earnest, conscientious and upright man. He was deeply attached to Kew; its interests were ever present to his mind and he lost no opportunity to serve them to the best of his ability. His colleagues and friends and all who were acquainted with him respected him in the highest degree, and those who knew him intimately regarded him with genuine affection.

The Indian Botanical Society.—We notice that in pursuance of a resolution passed by the Botany Section of the Indian Science Congress, at the Nagpur Meeting in January, 1920, a Society called "The Indian Botanical Society" has been founded for uniting the Botanists and Promoting the Botanical Interests of India.

The actual constitution of the Society took place on December 6th of last year, when the following officers were declared to have been elected to serve until the annual meeting in January, 1922:—

Winfield Dudgeon, Ph.D., Ewing Christian College, Allahabad City	President.
W. Burns, D.Sc., College of Agriculture, Poona	Vice-President.
Shiv Ram Kashyap, M.Sc., Government College and Panjab University, Lahore	Secretary-Treasurer.
Birbal Sahni, D.Sc., Panjab University, Lahore	Councillor for two years.
Rai Bahadur K. Rangachari, M.A., L.T., Agricultural College, Coimbatore	Councillor for one year.

The aims of the Society are stated to be :—

(1) To promote a feeling of fellowship among botanists, and draw them together for mutual benefit.

(2) To improve the quality and content of botanical instruction in colleges, universities, and other institutions.

(3) To encourage and promote research in botany.

(4) To provide a central exchange.

(5) To make available to members the scattered and insufficient botanical literature that reaches India.

The Society does not contemplate starting a botanical publication of its own, but encourages members to support the Journal of Indian Botany.

The Charter Members of the Society number 81.

Botanical Collections in Herbarium, Kew.—The entries on p. 36, lines 5–8 from top, of the *Kew Bulletin* for 1901, should be amended to read as follows :—

Johnston, Surg.-Maj. Henry Halcro. 1880–90. Afghan. Egypt, Orkney, Sierra Leone, Nubia, Mauritius. 462.

Johnston, Sir Harry Hamilton. 1883–97. Angola, Congo, Kilimanjaro, Cameroons. 1334.

A new European Plant.—A few weeks ago, Kew received from Mr. C. G. Field-Marsham, of Tunbridge Wells, a dried specimen of a plant which was collected on the steep cliffs of Cape Hellas, Gallipoli. It is apparently a form of *Gonocytisus angulatus*, Spach., a species new to the European flora. This plant is widely distributed in Asia Minor and is common in some parts. Specimens preserved in the Kew Herbarium indicate that the plant is found in the following areas : Bithynia, Troad, near Smyrna, Magnesia and Sardis, Caria, Isauria and Cilicia. No record of its having been previously discovered outside Asia Minor has been found. A good figure of the species is given in Sibthorp's Flora Graeca, tab. 672, under the name *Spartium angulatum*, and a description will be found in Boissier's Flora Orientalis, II, p. 47. W. B. T.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 4] [1921

XIV.—VARIABILITY OF THE CAMPHOR-YIELD IN CINNAMOMUM CAMPHORA.

S. T. Dunn.

During the last years of the 19th century in consequence of the rising price of camphor and of the increasing demand for it for the manufacture of cellulose, numerous enquiries were addressed to Kew from the warmer parts of the British Empire as to the feasibility of growing the Camphor Tree there and producing remunerative plantations. To circulate information on this subject a paper was published in the *Kew Bulletin* (1899, pp. 57–68), making suggestions for the guidance of intending planters and summarising what had already been done in the camphor-planting industry.

The production of camphor plantations was about that time taken in hand in many parts of the world and camphor was soon being produced from the leaves of the young saplings on the same plan as had been tried with success by Mr. Nock in the Government Gardens at Hakgala, Ceylon. As some of these plantations progressed and attempts were made to extract camphor from the leaves, complaints began to be heard (notably from Dominica, St. Vincent, and Mauritius), that many young trees would not yield anything but oil, from which no solid camphor could be produced. In the case of Mauritius nearly all the plants were "oil-yielding" and it became a question of considerable economic importance how to avoid such disappointing results.

The existence of worthless as well as valuable camphor trees had long been recognised by the camphor distillers in China, Japan, Formosa, Cochin-China and other places where *Cinnamomum Camphora*, Nees, was exploited as a wild or cultivated tree. But now that the same phenomenon was beginning to appear in newly-made plantations it became important to all concerned to discover a remedy.

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Numerous enquiries on the subject began to reach Kew and investigations were immediately instituted. Requests were sent out to the various Colonies where aberrant trees grew, asking that experiments might be made and that botanical specimens and full notes on their plantations might be sent to the Royal Botanic Gardens.

From these notes and from the recorded experiences of former practical exploiters as to the variations in the yield of camphor trees, the following notes have been drawn up as to the best way of establishing paying plantations.

The all-important matter to the camphor exploiter is the proportion of Camphor that a tree yields. The actual percentage of solid camphor obtainable and to a less extent the percentage of the various constituents of the oil—safrol, cineol, eugenol, etc.—determine the value of the tree. Oils are always among the by-products of camphor production, for the solid substance obtained from the distillation of the wood or leaves is invariably mixed with light and heavy essential oils. An "oil tree" is not therefore necessarily one that produces only oil, but one that yields a large proportion of oil, and that does not yield solid camphor in paying quantities.

Before suggesting means of producing plantations of camphor-bearing trees it will be necessary to enquire first into the cause of variation of yield and although the endeavour is now to obtain camphor by the distillation of the leaves, advantage may be taken of the experience of the camphor-wood distillers to throw some light on the cause of variation.

Causes of Variation.

The direct cause of the presence in the camphor tree of essential oils of varying constitution and quantity is to be found probably in the formation within the plant of Terpentinol (C_{10} H_{16}), which is gradually changed by the activity of the living cells into camphor (C_{10} $H_{16}O$). As this oxidization progresses different compounds appear and it is by their admixture in the products of the distillation that all the different oils and finally camphor itself are formed. (Grasmann in *Mitt. Deutch. Gesellsch.* vi. 303 (1895) and Dubard in *Bull. Econ. Indo-Chine*, 1909, 148).

If this theory is accepted, it is not surprising to find that the yield of camphor varies from month to month. Mr. Oishi writing in the *Chemical News* as early as 1884 (l. 74) enumerates a series of measurements to prove that much more camphor is obtained in Japan from camphor wood cut in the cool season than from that cut in the summer. The same observation was made by Mr. W. R. Price, writing from Formosa in 1912, as tending to account for the presence of so-called "oil trees" in that country. The cause of variation in the recorded yield of a tree in the Government plantation at Curepipe in Mauritius is

suggested, it is noticed, by Mr. Tempany to be the time of the year at which the leaves were clipped for distillation. If there is any other circumstance affecting the healthiness and cell activity of *Cinnamomum Camphora* it will on the above theory affect the yield of Camphor. This supposition gains support from Mr. L. A. Boodle's microscopic examination of the specimens of wood from the experimental plantations in Mauritius above referred to :—

" On re-examining No. 6 (from a tree said to yield camphor), fungal filaments were found in certain parts of the wood," he writes, " but were decidedly less abundant than in specimens 3, 4, and 7 (from " oil trees "). It is doubtful to what extent the growth of the fungus in the wood may have taken place after the trees were felled or the specimens were cut, but the distribution of the fungus in the latter rather suggests that the living trees were attacked to some extent. It is suggested as a mere possibility that, in these particular specimens, fungal attack of the wood may have had a deterring effect on the production of camphor, since the sample from a camphor-producing tree (No. 6) shows markedly less fungus than the other three specimens, which are samples of oil-producing trees (3, 4, and 7). Whether fungal disease of the wood is common in Mauritius, and whether it influences camphor production, cannot be satisfactorily dealt with except on the spot."

" In 3, 4, and 7, the secretion in the oil-cells in the wood is mostly yellow, while in 6, the oil-cells either appear empty, or, where a secretion is visible, it is nearly always colourless. This observation quite agrees with No. 6 being a camphor-producing sample, since loss of yellow colour in the secretory cells accompanies the transformation of the oil into camphor (Tschirch, *Die Harze u.d. Härzbehalter*, 1906, vol. 2, p. 1175). On comparing sections from different parts of specimens 3, 4, and 7, it appeared that the presence of yellow secretion in the oil cells was general in regions strongly attacked by a fungus, but that the yellow colour was mostly absent, or rarer, in the sounder portions of the wood."

It is noticed also in this connection that the climatic conditions of N. Formosa seem to favour a plentiful production of solid camphor, whereas in the south, according to a letter from Mr. Takeda written in 1919, many trees yield little solid camphor but large quantities of Sho oil and Yu-ju oil, the trees being known to the Japanese as Sho-gyu and Yu-ju respectively. In the climate of Florida the same species produces solid camphor mixed with an oil differing from the Japanese oils in its low percentage of safrol. (Hood & True in *Yearb. Dept. Agric. U.S.A.*, 1910, 459). Hood and True have shown the remarkable variation of camphor content in the leaves of trees growing under different conditions of shade and soil, and M. K. Bamber in his experiments in Ceylon has found evidence of the same fastidiousness. Mr. Carmody (formerly Director of Agriculture in Trinidad) in the

Times Trade Suppl. April 10, 1920, draws attention to a case in the Trinidad Botanic Gardens where transplanting caused small trees to recover and produce a normal quantity of camphor. From these observations it seems important to consider in the first place the situation most suitable for the camphor-tree and also to find by experiment the best time for clipping the leaves.

But there is another line of enquiry that may lead to useful results, viz. as to the existence of botanically distinct camphor-yielding varieties. One of the chief objects of Kew in obtaining specimens of the trees grown in various colonial plantations was to compare them with examples of the true species of China and Japan, and to determine whether the non-camphor-producing specimens differed in any botanical way from the valuable kind. Mr. Lan (*Bull. Econ. Indo-Chine* 1907, 205) believed that they did so differ, and that a red colour suffused the buds and twigs of the camphor-producing variety, while its absence marked the oil-producing trees. But these indications were admitted by Mr. Crevost in the same journal to be merely due to difference of exposure, and Mr. Eberhardt surmised that they are rather an indication of the degree of the maturity of the tissues than of any inherent peculiarity (*l.c.* 1909, 145). In further criticism of this supposed varietal character, Mr. Joseph Jones, Curator of the Botanic Garden of Dominica, states that even in green-twigged plants the red colour appears in drying. Further observations may prove that the appearance of red colouring, though not a permanent character is a useful indication of the time at which the camphor appears in the leaves. The smell of the crushed leaves is noticed to resemble that of camphor in the trees that yield that substance, whereas the "oil-tree" leaves smell of turpentine or eucalyptus. The Chinese are said to differentiate between the valuable and worthless trees in Formosa by this distinction. Whether this is a permanent character is not quite clear.

In 1912, Mr. W. R. Price collected specimens (*Price* 425) of an "oil-producing tree" growing wild in the forest in Formosa. This proves to be *Cinnamomum Camphora*, Nees, var. *glaucescens*, Braun, differing from the type in the glaucous colour of the under surface of the leaves. The variety was known to Braun as a cultivated tree in Java and in the Botanic Gardens in Berlin, and he described it as giving a smell more of terebinth than camphor. Meissner, however, in his monograph of *Lauraceae* (*DC. Prodr.* xv. 24), reported that the same specimens smelled of pure camphor. The variety has been known in cultivation for a long time, and a very old tree in the Botanic Garden at St. Vincent has the same character of producing no solid camphor.

Besides these two slight colour indications no visible varietal characters can be found in any part of the tree to separate "camphor" trees from "oil" trees. But a further line of endeavour should also be pursued. The occurrence of the so-called oil and camphor-trees side by side in the same wild or

cultivated surroundings suggests that there may be individual peculiarities which affect the chemical products of camphor trees without being accompanied by any corresponding outward characters. Such physiological varieties are known to exist. They were proved for instance by Mr. Whitby in the case of *Hevea brasiliensis* (*Ann. Bot.* xxxiii. 313), and Mr. Gamble in the new edition of his *Manual of Indian Timbers* (p. 297) refers to the existence of similar varieties in *Acacia Catechu*, Willd.[1]

Suggested lines of improvement.

From the statements above it is quite clear that in order to produce plantations of trees that will give good quantities of solid camphor, (1) seed should be secured from trees known to produce camphor. Probably seed of this kind could be obtained from Hongkong, as Mr. Green, in his Report on the Botanical & Forestry Dept. for 1919, refers to the Chinese distilling camphor in various parts of the New Territory. (2) Suitable climate and soil should be selected. (*See* Circular No. 12, published by the Division of Botany of the U.S. Department of Agric. in 1897, reproduced in the *Kew Bulletin*, 1899, 57). (3) Saplings must be planted so that they may be clipped conveniently. The article on camphor cultivation in the United States, in the *Agric. Dept. Yearbook* for 1910 (p. 449–460), part of which is reproduced below, gives exact instructions for forming and using camphor plantations in the climate of Florida, and Circ. 78 (1920) of the same Department describes a machine for harvesting the leaves. A few notes from Bulletin No. 15 of the Department of Agriculture Federated Malay States are added. (4) The best months for clipping must be ascertained by experiment as observations show considerable changes in the camphor content of the leaves as the growing season advances.

Extracts from "*Camphor Cultivation*," by S. C. Hood & R. H. True in *Yearbook Dept. Agric., U.S.A.*, 1910, 453–455.

Propagation.

"Camphor can be propagated by seed, cuttings, and root cuttings, but for commercial purposes the first method is to be preferred, except in cases of special varieties having some valuable characteristic which would not be reproduced by seed. In propagation by seed great care should be taken in the selection of the land for the seed bed. If possible, a rich, well drained soil which has been under cultivation in previous years should be found."

The Seed and Seed Bed.

"Too much emphasis cannot be placed on the preparation of the seed bed, since after the seeds are planted no cultivation can be given for three months."

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[1] See also Chevalier in *Revue de Bot. Appliquée*, i. 20 (1921).

"For convenience in future handling, the seed should be planted on hills 3½ ft. by 1½ ft., with three seeds to the hill, and covered about 2 in. deep. This method will require about 24 quarts of seed per acre and will produce enough trees for setting out 16 acres of field planting."

Cultivation.

"The seeds will begin to come up about three months after planting, but four or five months are often required for a full stand. The percentage of germination is very low and only about one-half the seeds may be expected to grow. Cultivation should begin as soon as possible, and as soon as a full stand is obtained the plants should be thinned to one in a hill and given a good dressing of high-grade fertilizer."

"The first season the plants should make a growth of 12 to 18 in., with a very large and vigorous root system. The treatment the second year should be the same, and at 26 months from planting the plants should be from 2 to 3 ft. high and well branched. At this time they are ready for field setting."

Growth.

"The root system of a two-year-old camphor tree consists of a taproot 1 in. in diameter at the top and about 3 to 5 ft. long. Up to this time the laterals are represented mainly by small fibres on the taproot. In transplanting under commercial conditions these fibres are killed and are not renewed as quickly as in some other trees."

Preparation of Land for Planting.

"The land should be well prepared by deep ploughing early in the fall and again worked just before the trees are set. It is desirable to lay off the rows in checks 6 by 15 ft., since this will facilitate later cultivation. The trees can be dug with a tree digger and should be cut back severely. All leaves and small twigs should be removed and the tree well headed back. The taproot should be cut back to 12 in. and all small laterals removed."

"The trees should be set at the same depth they were in the seed bed, and a small basin formed by the soil about them for the reception of water. One application of water should be given when the trees are set and one or two later on, as needed, if the rainfall is scanty. No growth will take place in the roots if dry soil is allowed to remain in contact with them, but too much water will cause the roots to sour and die."

Fertilizing and Cultivation.

"Cultivation should be thorough and frequent, and where it can be done, small crops, such as cotton, peas, and corn, should be grown between the rows for two or three years."

"At five or six years from the seed the trees should be 7 to 8 ft. high and very bushy. At this time the trees should be trimmed to shape them up into hedges and the first harvest should be secured."

Harvesting.

"On the Department's experimental plots the trees are planted in rows 15 ft. apart and 6 ft. apart in the row. They are grown to an A-shaped hedge 8 ft. high and 8 ft. wide at the base. By this method they are kept back to a convenient size for working and are not dwarfed sufficiently to injure the vigour of the tree. At six years from the seed the trees will form a solid hedge in each row and will be thick and bushy to the ground."

"Camphor is represented in the growing tissue by oil, which as the leaves mature is changed into camphor. Distillations made at different times during the growing season show a rapid gain in camphor content as the leaves approach maturity; also that it is highest during the dormant period."

Extract from article by B. J. Eaton in *Bulletin* 15, *Dept. Agriculture, F.M.S.*, pp. 10 and 11.

Propagation of Camphor.

"The seeds were soaked in lukewarm water for 24 hours before sowing. The soaking of the seed facilitates germination and separates the heavy seeds from the light. The heavy seeds sank to the bottom and these were sown by themselves in rows 3 in. apart each way and about $\frac{1}{4}$ of an inch below the surface. The light seeds were sown broadcast as only a few were expected to germinate."

"When the plants are from 10 to 12 in. high they may be transplanted, but, before doing so, it is advisable to cut off the tops of the seedlings and the ends of the roots. Transplanting should be done during the wet season and care taken to keep the young plants free from weeds as these retard their growth."

"Nursery Beds.—The beds should be well prepared by deep digging and the surface soil brought to a fine tilth. As the seeds take from two to six months to germinate, sand should be added in order to make the soil sufficiently porous to prevent the seeds rotting. It is essential to water and shade the seedlings carefully."

XV.—SPECIES PLACED BY SACCARDO IN THE GENUS PHOMA.

Part III.

W. B. Grove.

The present communication is a continuation of those which have appeared in the *Kew Bulletin* for 1919, pp. 177–201 and 425–445. The three parts together form a revision of most of those doubtful species of *Phoma*, of which specimens are preserved at Kew, and which were included in Saccardo's *Sylloge*, vol. III. But there are two limitations of its scope: (1) those previously treated of in my "British Species of *Phomopsis*" (*Kew Bulletin*, 1917, pp. 49–73) are not again referred to, and (2) none are mentioned except those of which good and, so far as possible, authentic examples were available. The absence of some which one might have expected to be included is due, in nearly every case, to the poverty of the specimens at hand, which might have led to erroneous conclusions. Moreover, the enquiry has not as yet been extended to those species which are contained in the later volumes of Saccardo, although some of them are equally in need of revision.

It is satisfactory that, by this means and by the labours of von Höhnel and other workers elsewhere, the genus *Phoma* has now been relieved of many species referred to it by the older mycologists, who regarded it as a convenient receptacle for doubtful forms. The genus *Macrophoma*, too, has almost disappeared.

It becomes plain, after examining a series of so-called species of *Phoma* like these, that there is a great possibility, and in many cases a certainty, of recognising the genus to which they really belong, even though the spores may be very young and so may not show the nominal generic character. The genera *Phoma*, *Phomopsis*, *Ascochyta*, *Diplodina*, *Diplodia*, etc. (not to mention *Sphaeropsis*, *Coniothyrium* and the *Leptostromaceae*) all have, even when imperfectly developed, certain distinctive traits which are suggestive, if not decisive. These traits should encourage a more persistent search, and, as many instances have shown, such a search will often be at length rewarded by the discovery of a few more fully-formed spores scattered among the rest. Apart from this, it is now beginning to be recognised that the nature of the pycnidium, and especially its texture, is in many cases as characteristic as any other feature of the Coelomycetes.

In what follows all figures, except where otherwise described, are × 600.

SPECIES TO BE TRANSFERRED TO PHOMOPSIS.

951. Phoma Yuccae, *Cooke*.

Phoma Yuccae, Cooke, in Grevill. 1878, vii. 32.
PHOMOPSIS YUCCAE, *Trav.* Flor. Ital. Crypt. Fung. ii, p. 221.

Phoma (*Diaporthe*) *gloriosa*, Sacc. in Mich. ii. 274 (1881); Syll. iii. 159.

Pycnidia gregarious, mainly on bleached spots which are surrounded by a dusky margin, elliptic, depressed, black, about 250 μ long, each often bordered by a brownish or blackish halo. Spores elliptic-fusoid, acute at both ends, occasionally biguttulate, 7·5–9 × 2–3 μ; sporophores subulate, curvulous, about 13–15 × 2–2·5 μ.

On flower-stalks of *Yucca filamentosa*, Aiken, South Carolina (Ravenel, nos. 2580 !, 2581 !).

Cooke's specimens are obviously the same species as that of Saccardo, which was on leaves of *Y. gloriosa*. They belong to *Diaporthe gloriosa*, Sacc. & Speg. (Syll. i. 660).

954. Phoma brunneola, *Sacc.*

Sphaeropsis brunneola, Berk. & Curt. N. Amer. Fung. in Grevill. 1874, iii. 1.

PHOMOPSIS BRUNNEOLA, *Grove*.

Pycnidia crowded, imperfect, oblong, often curved, covered by the discoloured epidermis, brownish-black, up to 500 μ long, somewhat hysterii-form, occasionally confluent. Spores exactly fusoid, very acute at both ends, or rarely broader towards one end, sometimes guttulate, 9–10 × 2–3 μ; sporophores subulate, straight, about as long as the spore.

On dead stems of *Smilax*. Specimens examined :—

Sphaeropsis brunneola, B. & C. on *S. rotundifolia*, New England, Sprague (Berk. Herb. no. 5269 !).

Phoma Smilacis, Gerard (*non* Boy. & Jacz.) on *Smilax*, Poughkeepsie.

Phoma Smilacis, on *Smilax*, Newfield, New Jersey (Ellis, no. 2914 !).

Most obviously a stage of a *Diaporthe*, but no *Diaporthe* on *Smilax* seems to be known. On the same stems, in Ellis, no. 2914, is the young state of *Diplodia smilacina*, Berk. (Sacc. Syll. iii. 370), with spores still uncoloured. One might easily suspect that *Phoma smilacina*, Sacc. Syll. iii. 160 (*Sphaeropsis smilacina*, Peck = *Macrophoma smilacina*, Berl. & Vogl. Syll. Addit. p. 314) is nothing else than the fusoid-spored state of this *Diplodia*, but no specimens of the "*Macrophoma*" have been seen.

961. Phoma Convallariae, *Westd.*

PHOMOPSIS CONVALLARIAE, *Grove.*

Pycnidia scattered, but often two or three surrounded by a thin brownish *Diaporthe*-like line, oblong, blackish, covered by the epidermis which at length splits above, mostly imperfect, floored by the usual soft brownish parenchymatous tissue. Spores elliptic-fusoid, usually acute, biguttulate, the guttules distant from the extremities, occasionally appearing 1–septate, 8–9 × 1·5–2·5 μ; sporophores linear-subulate, longer than the spore.

On stems of *Polygonatum multiflorum*, Namur (Westd. Herb. Crypt. Belg. no. 1136 ! *forma caulicola*). The pycnidium consists chiefly of the discoloured matrix.

Saccardo's subspecies *Phoma polygonatea* (Mich. ii. 617), at least as represented in Roum. Fung. Gall. Exs. no. 3674 !, does not seem to differ in any respect whatever. Evidently the pycnidium of a *Diaporthe*, and without doubt that of *D. pardalota* (Mont.) Nits. apud Fckl. (Sacc. Syll. i. 693).

SPECIES TO BE TRANSFERRED TO PLACOSPHAERIA.

935. Phoma maculata, *Sacc.*

Sphaeropsis maculata, Cooke & Hark. in Grevill. 1884, xii. 93.
PLACOSPHAERIA MACULATA, *Grove.*

Stroma widely effused, blackening the epidermis for several inches, whitish within; pycnidial chambers up to 1 mm. diam., convex, very prominent, oblong, then erumpent with a black rugulose disc which is at length pierced by 1–4 whitish spots where the spore-mass bursts through the surface. Spores elliptic-fusoid, pointed at one or both ends, granular or 1–guttulate, 8–10 × 3·5–5 μ; sporophores crowded, subulate, up to 15 μ long. (Fig. 1.)

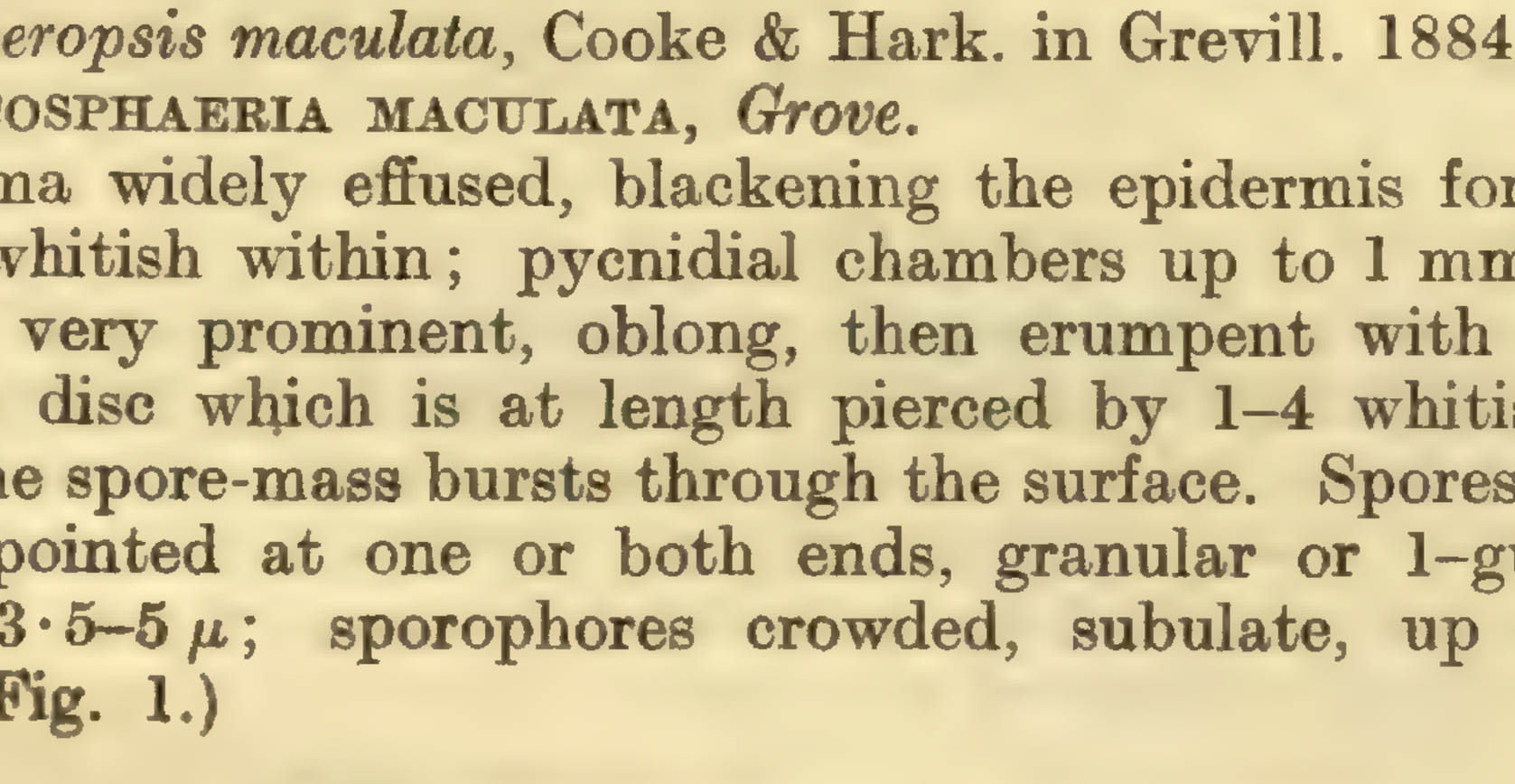

FIG. 1.—*Placosphaeria maculata*; *a*, horizontal section of pustule, showing the three layers A, B, and C, × 60; *b*, vertical section of pustule, showing two of the openings by which the spores emerge, × 30; *c*, cells of the outer wall, A; *d*, sporophores, *in situ*; *e*, spores.

On fading leaves, petioles, and stems of Palms, California (Cooke, Herb. no. 2546 !); on fading leaves of *Chamaerops excelsa*, Portugal, Moller (Roum. Fung. Sel. Exs. no. 4464 !).

This is a *Placosphaeria*, for in *Dothiorella* there is no outward black layer of epidermis. The external appearance resembles that of *Placosphaeria* (*Rhytisma*) *Urticae*, Sacc. = *Melasmia Urticae*, Grove in Journ. Bot. 1918, p. 319, but the pustules are much larger. Each is imperfectly divided into several chambers, which are filled with a colourless mass of spores. The outer wall of the pustule is many cells thick, the outer layer and the inmost of which are dark-brown (cells 5–6 μ diam.), the middle part being paler. The three layers A, B, and C, are shown in vertical and horizontal section in fig. 1, *a* and *b*; A = the altered black epidermis, B = the less altered cortex, partly of fungous cells, C = the inner wall from which the sporophores spring. But C shades into B, there is no abrupt transition; at the base only C is present. The part of the matrix occupied by the fungus forms a large black patch extending for a considerable distance; the older pycnidia fall out of this, and leave pale roundish pits or scrobiculations.

SPECIES TO BE TRANSFERRED TO DIPLODIEAE.

908. Phoma malorum, *Sacc.*

Sphaeropsis malorum, Berk. Outl., p. 316 (1860).

Sphaeropsis malorum, Peck, Ann. Rep. 1881, xxxiv. 36, pl. 4, figs. 16–21. Sacc. Syll. iii. 294.

Macrophoma malorum, Berl. & Vogl. Syll. Addit. p. 310.

Diplodia Pseudodiplodia, Fckl. Symb. Myc. p. 393.

Diplodia malorum, Fckl. Symb. Myc. p. 395.

Berkeley's original specimens were examined; as is well-known, they are merely young *D. malorum*, Fckl. They yielded abundant colourless spores, and many tinged with dilute brown ("sporulis chlorino-hyalinis"), but also not a few which were decidedly of a *Diplodia* brown, though none were found with a septum. They do not differ in any respect from those of Peck, and correspond in all their characters with the ordinary young *Diplodia*. It should be noticed that *D. malorum*, Fckl. is merely a synonym (two pages later) of *D. Pseudodiplodia*, Fckl., but the former name should be preferred, since the latter is inappropriate and inconsistent—a true *Diplodia* cannot be a "false-*Diplodia*."

910. Phoma samaricola, *Sacc.*

Macrophoma samaricola, Berl. & Vogl. Syll. Addit. p. 310.

Sphaeropsis samarorum, Mont. cent. vi, no. 89 !

? Diplodia atrata, Sacc. Syll. iii. 331.

Pycnidia subgregarious, lens-shaped, black, 80–100 μ diam., covered by the epidermis except for the ostiole; texture olive-brown, rather thin, parenchymatous. Spores oblong-fusoid,

rounded at the ends, straight in front view, narrower and curved in profile, colourless, granular within, occasionally biguttulate, 16–20 × 4·5 — 5·5 μ; sporophores not seen. (Fig. 2*a*.)

On the samarae of *Acer Pseudoplatanus*, *A. Negundo*, on the pericarp, not on the wings. The figure is taken from spores of Montagne's own specimen in Herb. Berk., named in Montagne's handwriting "*Sphaeropsis samarorum*, Mont."

These fusoid spores remind one of the others like *Phoma fusigera*, *P. fusispora*, *P. Ricini* (*ante*, 1919, pp. 191–3, 437), so that, except for the thin pycnidial wall, one could at once accept this as a mere young state of a *Diplodia*. If so, it belongs to *Diplodia atrata*, Sacc., which occurs on bark of *Acer Pseudoplatanus* and *A. Negundo*, and has equally inconspicuous sporophores, but is thick-walled. It may be taken as a certainty that the idea, prevalent up to Saccardo's time, that the fungi found upon twigs or branches must be different from those found upon the leaves, fruits, and other parts of the same plants, has little or no foundation; but it is true that those forms which occur on the less bulky structures, like samarae, are slighter in texture than those on the thicker parts.

As an instance of what could be done by those who followed the old tradition, there is in the Herbarium under the name *Phoma samaricola* a specimen issued by Fuckel ("*Phoma ellipticum*, Fckl." Fung. Rhen. no. 2128 !), on rotting samarae of *Acer platanoides*, which is obviously a *Phomopsis*, and probably = *Phomopsis platanoidis*, Died., probably also *Phoma Aceris-Negundinis*, Arc., is another synonym of the same species.

Thus there can be found on samarae of *Acer* at least three fungi, similar at a cursory glance, but differing considerably in their spores, (1) *Phomopsis platanoidis*, Died., (2) *Phoma samararum*, Desm., and (3) *Macrophoma samaricola*, B. & V., of which (1) belongs to a *Diaporthe*, (2) to a *Pleospora*, and (3) probably to a *Diplodia* and perhaps ultimately to a *Botryosphaeria*.

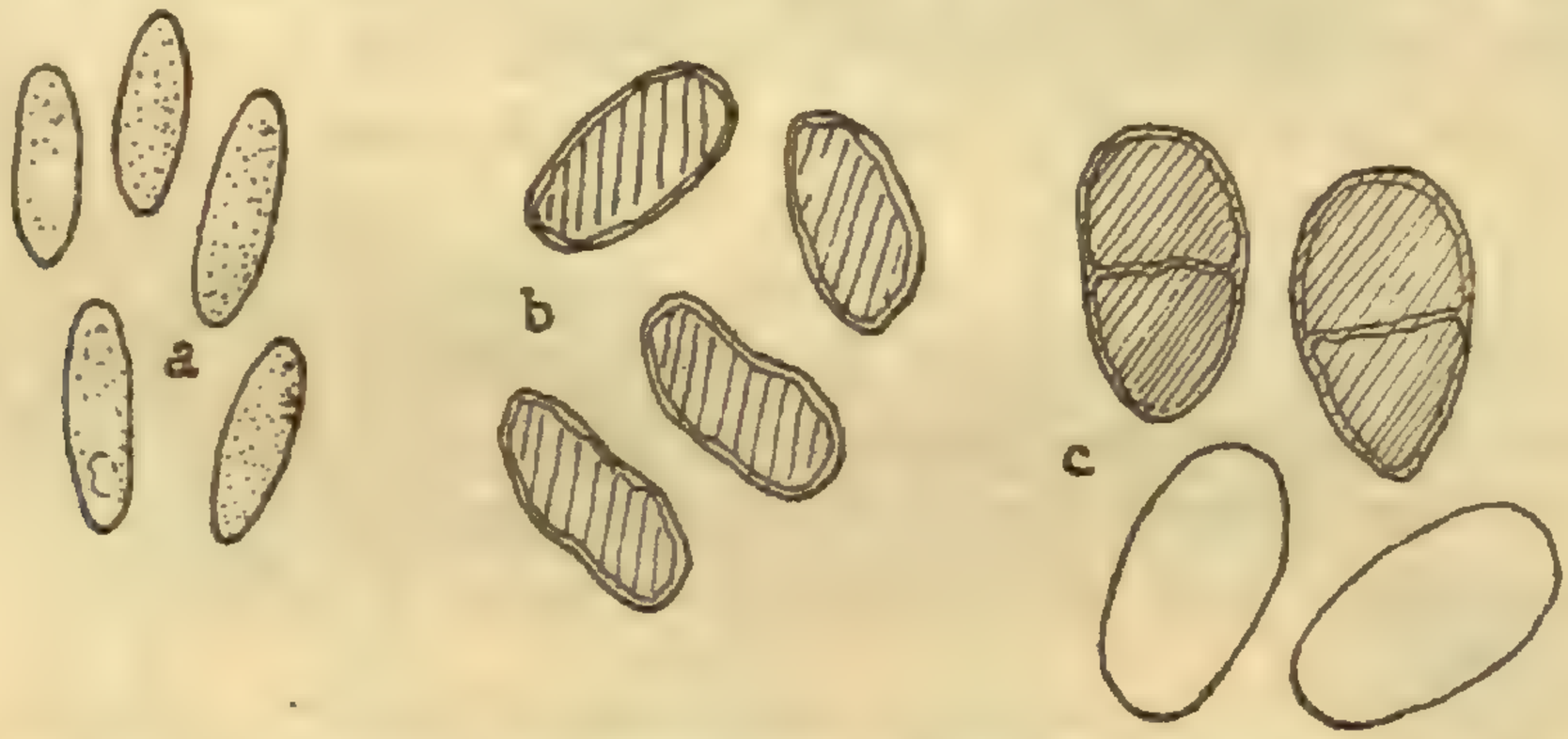

FIG. 2.—*a*, "*Sphaeropsis samarorum*, Mont.," spores from Montagne's specimen in Herb. Berk.; *b*, "*Sphaeropsis Palmarum*, Cooke," spores from Cooke's specimen; *c*, "*Sphaeropsis Pandani*, Lév.," spores from the specimens sent by Léveillé to Berkeley.

933. Phoma Palmarum, *Sacc.*

Sphaeropsis palmarum, Cooke, in Grevill. 1877, v. 101, pl. 86, f. 1 (on petioles and midribs of *Cocos nucifera*).

Macrophoma Palmarum, Berl. & Vogl. Syll. Addit. p. 311.
DIPLODIA EPICOCOS, Cooke, in Grevill. *ibid.* p. 102, pl. 86, f. 2.
D. palmicola, Thüm. Sacc. Syll. iii. 372.

Cooke's specimens of the *Sphaeropsis* are evidently a young *Diplodia*, recognisable as such at the first view of the granular spores: although all the spores seen were eseptate, many of them had a brownish wall. (Fig. 2*b*.) The best developed pycnidia (even though the spores still remained quite colourless) were exactly like those of *D. epicocos*, and the spores of the latter (in Cooke's own specimens) were often mixed in the same pycnidium with colourless ones like those of the "*Phoma*." *D. palmicola*, Thüm. (Fung. Austr. no. 59 !), on epicarp of *Cocos*, does not differ in any respect except words. Cooke's figure (pl. 86, f. 2) is misleading; the *Diplodia* spores are rarely constricted, and have the septum broad and dark.

939. Phoma Pandani, *Sacc.*

Sphaeropsis Pandani, Lév. in Ann. Sci. Nat. 1846, v. 293.
Macrophoma Pandani, Berl. & Vogl. Syll. Addit. p. 310, and x. 197.
? DIPLODIA PANDANI, *Tassi ; see* Sacc. Syll. xvi. 923.

This is another instance of what has been noted so many times. The older observers of these fungi (it was the custom of their age) paid no attention to the changes which spores undergo during their development. On examining the authentic specimens sent by Léveillé to Berkeley, it is seen that the pycnidia contain numerous large hyaline spores, but mixed with them are a small number of brown spores, mostly uniseptate, with all conceivable intermediate stages. (Fig. 2*c*.) Evidently it is a *Diplodia* or a *Botryodiplodia* (the latter is partly, if not entirely, merely a state of the former); but it does not seem to agree entirely with *Diplodia Pandani*, Tassi (Sacc. Syll. xvi. 923), "on dry fruits of *Pandanus utilis*, Madagascar." Nevertheless it may be that species.

Léveillé's original account (*l.c.*) is very accurate, and need not be repeated here: the spores are elliptic-oblong or obovoid, at first quite colourless and very thin-walled, at length dark-brown and 1-septate, 23–25 × 14–15 μ. The pycnidia are, as Léveillé states, distinct but "très rapprochés," each enclosed in the ruptured epidermis and surrounded by a thin layer of brown creeping branched fibres. Léveillé's specimens have no locality affixed, but were apparently found on dried fruits of *Pandanus*, preserved in the herbarium of the Paris museum.

946. Phoma elongata, *Sacc.*

Sphaeropsis elongata, Berk. & Curt. in Grevill. 1874, ii. 181.
Macrophoma elongata, Berl. & Vogl. Syll. Addit. p. 314.

Pycnidia gregarious, globose-depressed, 150–250 μ diam., black, covered by the epidermis, then erumpent by the upper

half, pierced by a pore, surrounded by dark-brown creeping hyphae, at length collapsed; texture thick, opaque, dark-brown. Spores elongate-fusoid, rounded at both ends, granular, colourless, 20–25 × 4·5–5·5 μ; sporophores oblong, thick, more or less curved, blunt at apex, colourless, 15–16 × 3–4 μ. (Fig. 3*a*.)

On stems of *Gladiolus*, Alabama, Peters (Herb. Berk. no. 5231 !) *See also* the next species.

In some of the larger pycnidia actual *Diplodia*-spores were to be seen, translucent, pale-brown, somewhat fusoid, 18–20 × 5–6 μ, but no intermediate stages could be detected. Nevertheless, it is impossible to come to any other conclusion than that the two kinds of spore belong to the same fungus: the cases now established of such a connection are too numerous to permit of any doubt. So far, however, no *Diplodia* on *Gladiolus* seems to have been described. The appropriate name for this would be *Diplodia elongata*; the species of the genus, which have spores that are fusoid when young, should form a distinct section, the Fusisporae. *See* nos. 910 and 994.

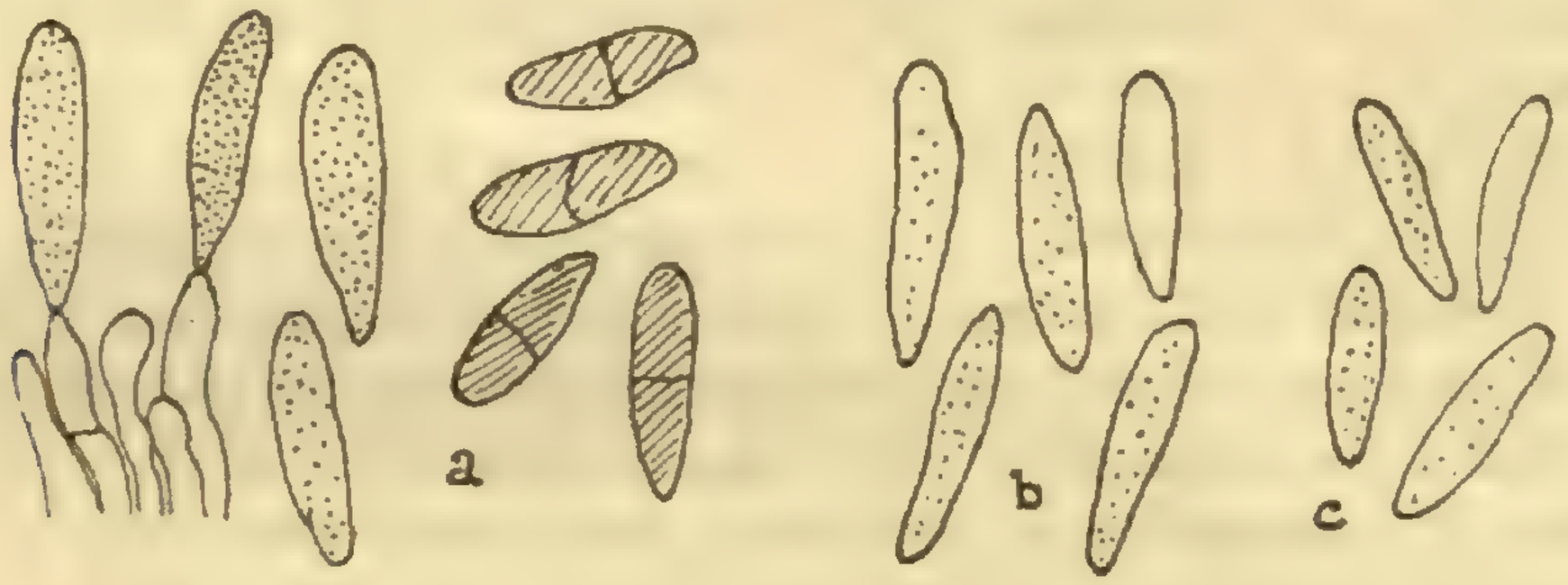

FIG. 3.—*a*, "*Sphaeropsis elongata*, B. & C.," spores from the specimen on *Gladiolus* (Herb. Berk. no. 5231), young spores on the left, mature on the right; *b*, "*Sphaeropsis lanceolata*, Cooke & Ell.," spores from Ravenel, no. 3106, on *Gladiolus*; *c*, the same, from Ellis, no. 3011, on *Asparagus*.

967. Phoma lanceolata, *Sacc.*

Sphaeropsis lanceolata, Cooke & Ell. in Grevill. 1878, vii. 38.
Macrophoma lanceolata, Berl. & Vogl. Syll. Addit. p. 314.
? DIPLODIA GEORGINAE, Lév. in Ann. Sci. Nat. 1846, p. 292.

Pycnidia crowded or gregarious, black, 200–300 μ diam. or even more, rather prominent, covered, then erumpent; texture very thick and dark, parenchymatous, consisting of several layers. Spores lanceolate-fusoid, tapering (but still obtuse) at both ends, very granular within, 23–25 × 4·5–5 μ; sporophores slender, linear, about as long or longer. (Fig. 3, *b* and *c*.)

On dead stems of *Gladiolus*, South Carolina (Ravenel, no. 3106 !); on *Dahlia* (*ibid.* no. 3107 !); also on *Gladiolus* (Cooke and Rav. Fung. Amer. exs. no. 544 !); on *Asparagus*, Newfield (Ellis, Fung. N. Amer. no. 3011 !).

On the same sheet, under the same name, is a fungus on Nettle stem (Ellis, Fung. N. Amer. no. 1229 !) which is chiefly *Didymella superflua*, Sacc., with its associated *Phoma*, but no

Phoma lanceolata. But the specimens on *Gladiolus*, *Dahlia*, and *Asparagus*, are all very much alike and belong to the same group as the *Phoma fusigera* already mentioned (*see* under no. 910). They probably belong to *Diplodiae* such as *D. Georginae*, Lév., but what they really mean cannot be decided now. Cooke gives the spores on *Asparagus* as 30 × 7 μ, but none so large were seen; they were mostly even shorter than on *Gladiolus*.

972. Phoma Musae, *Sacc.*

Sphaeropsis? *Musarum*, Cooke, in Grevill. 1880, viii. 93.
Macrophoma Musae, Berl. & Vogl. Syll. Addit. p. 311.
? Diplodia Radula, B. & Br. Fung. Ceyl. no. 785. Sacc. Syll. iii. 371.

The following specimens were examined :—

"*Sphaeropsis Musarum*," Cooke, Herb. no. 230 !, Belgaum, India, coll. Hobson. (Fig. 4*a*.)

"*Macrophoma Musae*," Sydow, Fung. Exot. Exs. no. 189 !, Manilla, coll. Graff. (Fig. 4*b*.)

(Both of these are on dead leaves of *Musa paradisiaca*, but it is also recorded by Petch on fruits of Plantain, Peradeniya).

"Diplodia Radula," Herb. Berk.n o. 305 !, on leaves of *Musaceae*, Ceylon. (Fig. 4*c*.)

Cooke's specimens (no. 230) have the pycnidia in dense round clusters : they suggest at the first glance a *Botryodiplodia*, for under the microscope all the characters of a young *Diplodia* are present, except that there were no sporophores visible. Now Berkeley described his *Diplodia Radula* on leaves of Musaceae, but his specimens (no. 305) show no signs of having the pycnidia conglomerated; nevertheless the gap is bridged over by Sydow's specimens (no. 189), for in them there are numerous single pycnidia, and also they show many clusters exactly like those of Cooke's no. 230.

It is therefore suggested that *Macrophoma Musae* = *Diplodia Radula*, B. & Br., although with reservation. The spores of both are all but the same, for most of the spores of Berkeley's specimens of his *Diplodia* are colourless, though granular, and are nearly of the same size and appearance : only a few of the older pycnidia were exuding long strings of brown 1–septate spores. Sydow's spores are smaller than those of Cooke. In all these specimens, including *D. Radula*, no sporophores are now discernible; this is known also to be the case in *D. atrata*.—In Berkeley's specimens (no. 305) long slender gelatinous paraphyses occur similar to those which are found in some pycnidia of *Botryodiplodia Theobromae*, Pat., and the pycnidial walls show traces of the same violet- or purple-brown tinge as it possesses. Is it possible that the *Diplodia* on *Musa* is only a biologic form of *B. Theobromae*? *Musa* is not mentioned among the hosts of that species by Petch (*see* the next no.

Phoma Sacchari), but this suggestion deserves consideration by tropical mycologists.

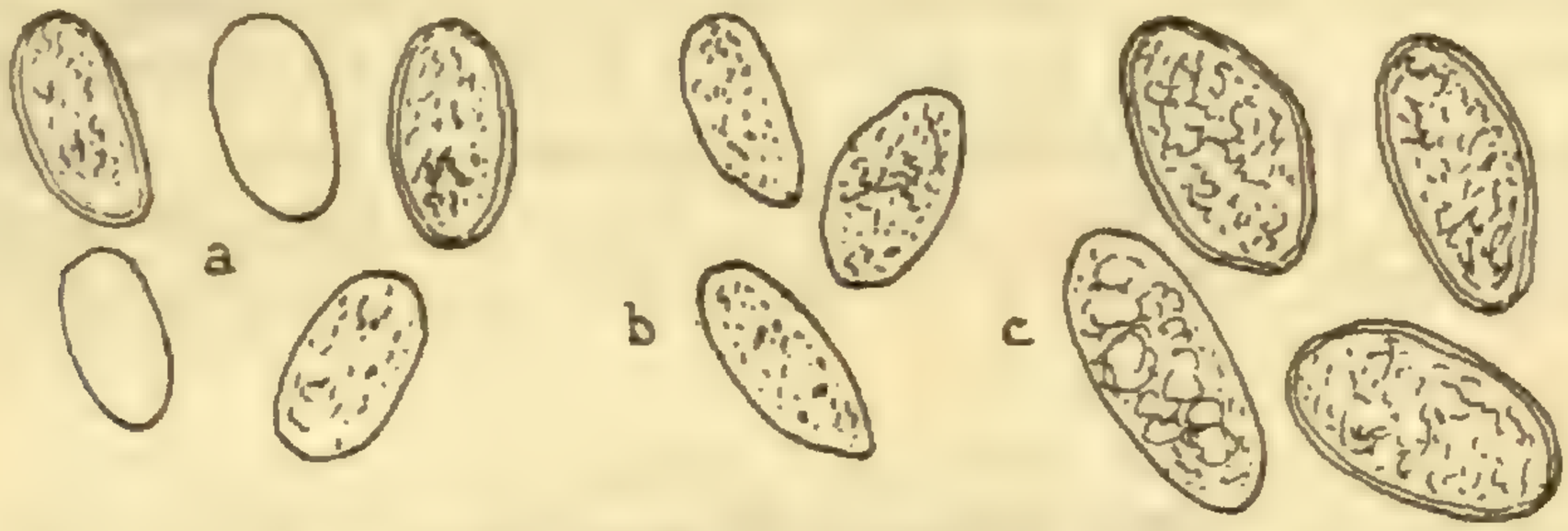

FIG. 4.—*a*, "*Sphaeropsis Musarum*, Cooke," no. 230; *b*, "*Macrophoma Musae*, B. & V.," from Sydow, no. 189; *c*, "*Diplodia Radula*, B. & Br.," from Berk., no. 305 (young colourless spores, among the coloured ones).

994. Phoma Sacchari, *Sacc.*

Sphaeropsis Sacchari, Cooke, in Grevill. 1883, xii. 23.
Macrophoma Sacchari, Berl. & Vogl. Syll. Addit. p. 311.
M. vestita, Prill. & Delacr. in Bull. Soc. Myc. Fr. 1894, p. 165, pl. 6, f. C. Sacc. Syll. xi. 496.
BOTRYODIPLODIA THEOBROMAE, *Pat.* in Bull. Soc. Myc. Fr. 1892, p. 136. Sacc. Syll. xi. 522.

The "*Macrophoma*" is obviously an immature state of *Botryodiplodia Theobromae* (which is known to occur on *Saccharum*), and is plainly the same as *M. vestita*, except that the clothing of hairs is wanting and that the spores are less ovoid and more lanceolate. Cooke's specimens examined (Ravenel, no. 3173 ! = Cooke & Rav. Fung. Amer. Exs. no. 693 !, on Sugar-cane, Georgia) have exactly the pycnidial texture of the *Botryodiplodia*, even including the faint tinge of purple, and after a long search numerous brown, but eseptate, spores were at last discovered in some of the pycnidia: they may be called f. *Sacchari*.

With regard to the hairs of *M. vestita* the epoch-making work of Petch on *Lasiodiplodia* (Ann. Roy. Bot. Gard. Peraden. 1910, iv. 445) is conclusive; the hairs are produced on the outside of the fungus when it is growing in a damp atmosphere (*M. vestita* grew on *roots* of *Theobroma*), but on the dry stems they would be altogether wanting. As regards the lanceolate spores, this is evidently another case comparable to those mentioned before under *P. fusigera* (*see* no. 910); what the exact meaning of these lanceolate or fusoid spores may be has yet to be determined, but there can be no doubt that in certain circumstances a *Diplodia* or a *Botryodiplodia* produces them.

Thus four or five fresh names (besides the round dozen summed up by Petch) become mere synonyms of *Botryodiplodia Theobromae*, Pat. Anyone who has access to a sufficient number of original (type) specimens could carry on this process to a considerable extent, apart, that is to say, from biological differences. These latter, however, as usually stated, are largely illusive; for they are dependent to a degree which they do not yet admit

on the manipulative methods of the experimenters, as Eriksson has quite unwittingly demonstrated again and again. In this way the overwhelming number of "species" now described can be slowly reduced to a more manageable compass. But this must not be done from mere book descriptions.

If, in addition, investigators would consent to adopt the simple plan of ranging "biologic" forms or races under a common head without confusing the issue by adopting the common title as a name also of one of the subordinate forms, the vast mass of names would be brought more and more within the limits of comprehension.

SPECIES TO BE TRANSFERRED TO HYALODIDYMAE.

947. Phoma Gladioli, *Sacc.*

Sphaeropsis Gladioli, Cooke, in Grevill. 1883, xii. 23.
Macrophoma Gladioli, Berl. & Vogl. Syll. Addit. p. 311.
Ascochyta Gladioli, *Trav. & Spess.* in Bolet. Soc. Brot. 1910, xxv. 180, pl. 3, f. 20. Sacc. Syll. xxii. 1027.
? *Phoma conimbricensis*, Trav. & Spess. *ibid.* p. 175, pl. 2, f. 8.

Spots often roundish, about 4–5 mm. diam., bleached or pallid. Pycnidia grouped, often in circles, globose-depressed, 130–150 μ diam., blackish, covered by the epidermis, then erumpent, pierced at the apex by a pore; texture thin, plectenchymatous, honey-coloured or darker. Spores cylindric-oblong, at length thinly 1-septate, not or faintly constricted, often slightly curved, granular within, colourless, 15–18 $\times$ 4·5–6 μ. (Fig. 5*a*.)

On leaves of *Gladiolus*, South Carolina (Ravenel, no. 2956!).

The greater part of the spores in Ravenel's specimens are eseptate, but there is noticeable a slight constriction and bending of many spores, which serves as an omen of the true state of things, and here, as usual in such cases, persistent search reveals a number of them which are 1-septate. Moreover the texture of the pycnidium is that characteristic of *Ascochyta*. Cooke wrongly gives the size of the spores as 20 $\times$ 5 μ. There can be no doubt that *Phoma Gladioli*, (Cke.) Sacc. is the same fungus as *Ascochyta Gladioli*, Trav. & Spess., although those authors give the size of their spores as being 12–15 $\times$ 2·5–3 μ. They also record (*l.c.*) a fungus to which they give the name *Phoma conimbricensis*, as accompanying the *Ascochyta* on scapes of *Gladiolus cardinalis* in the Botanic Gardens at Coimbra, Portugal. A comparison of the descriptions, and a knowledge of what is now known to take place in many other cases, enables one to presume with certainty that *Phoma conimbricensis* is merely the young state of the *Ascochyta*. It is time that systematists (and pathologists also) began to admit more readily that such a sequence of states is a quite common phenomenon. When once its existence is

recognised, the proofs of its occurrence are easily observed, and many superfluous synonyms might be thereby avoided.

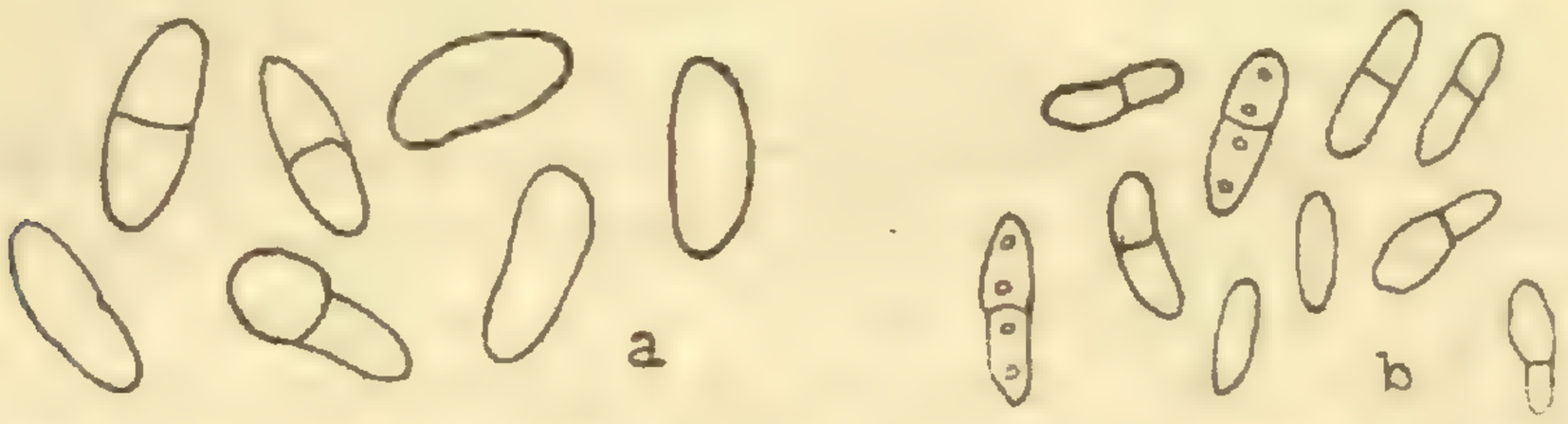

Fig. 5.—*a*, "*Sphaeropsis Gladioli*, Cooke," spores from Ravenel, no. 2956; *b*, "*Sphaeropsis epitricha*, B. & Br.," spores from Broome's specimen.

1005. Phoma epitricha, *Sacc.*

Sphaeropsis epitricha, B. & Br. in Ann. Nat. Hist. 1850, v. 375.

Ascochyta Equiseti, *Grove*, in Journ. Bot. 1918, p. 315 (var.).

Phoma Equiseti, Desm. Exs. no. 183. Sacc. Syll. iii. 168; x. 187. Allesch. vi. 341.

Sphaeria Equiseti, Sacc. Syll. ii. 442.

? *Diplodina Equiseti*, Sacc. in Annal. Mycol. 1905, p. 233; Syll. xviii. 355.

? *Stagonospora Equiseti*, Fautr. in Rev. Mycol. 1890, p. 124; Sacc. Syll. x. 337.

The specimens to which Berkeley gave the name *Sphaeropsis epitricha* were found on dead stems of *Equisetum palustre*, in Wiltshire, by Broome. Berkeley's description of the "subiculum" is a little misleading. The pycnidia are surrounded by numerous creeping branched, somewhat torulose, brown hyphae, about 4 μ broad. It is this which causes the "cinereous spot." The pycnidia are about 160 μ wide, thick-walled, of a dark-brown texture, prominent and at length piercing the epidermis by a rather wide pore. Some of the numerous spores look at first sight like what Berkeley described, but, on adding dilute potash (which presumably restores them to their pristine shape and size), they assume the appearance of *Ascochyta* or *Diplodina* spores, 10–16 $\times$ 3·5–4·5 μ, oblong, obtuse at the ends, often slightly bent, with a few guttules and often a faint septum, quite colourless, cells occasionally unequal. (Fig. 5*b*.)

There cannot be the slightest doubt that this species is in the state which is usually called *Diplodina*, taking that genus to differ from *Ascochyta* in the nature of its pycnidial wall (thick and dark, not thin and pale). At the same time it seems probable that it is only a more fully developed state of *Ascochyta Equiseti*, mihi. And as I have proved that that is an advanced state of what has long been called *Phoma Equiseti*, the three are probably synonymous. The spores of the "*Phoma*" can be traced *in the same pycnidium* from ovoid, eseptate, 6–7·5 $\times$ 3 μ, up to oblong, 1-septate, 10·5–12 $\times$ 3–3·5 μ; those of *Diplodina Equiseti*, Sacc., are given as cylindrical, 16–19 $\times$ 4–4·5 μ, at

length minutely 4-guttulate; moreover Diedicke and others have found the *Phoma* and the *Diplodina* "growing in company." Those of the "*Sphaeropsis*" just fill up the gap. Finally there does not seem to be any reason why *Stagonospora Equiseti*, Fautr., should not be considered a still further development of the same fungus, with cylindrical 3-septate spores, 20–25 × 4–5 μ. They all occur on the same host, stems of *Equisetum* (chiefly *E. limosum*). It may be mentioned, finally, that *Phoma Equiseti*, Lév. (Ann. Sci. Nat. 1846, p. 282) differs from *P. Equiseti*, Desm. merely in having spores of a more ellipsoid form, but all the forms from round to oblong may easily be found in the same pycnidium.

SPECIES TO BE TRANSFERRED TO LEPTOSTROMACEAE.

987. Phoma donacella, *Sacc.*

Coniothyrium donacinum, Thüm. Contr. Myc. Lusit. no. 340.
LEPTOSTROMA DONACINUM, Sacc. Syll. iii. 642.
L. Donacis, Sacc. in Mich. ii. 352.

The specimen examined was one of Thümen's own, on dead culms of *Arundo Donax*, Coimbra (Flora lusitanica, legit Moller). It is obviously a *Leptostroma*, and there is no difference between it and *L. donacinum*, Sacc. It should therefore stand as L. DONACINUM (Thüm.), Sacc.; moreover it is the same as *L. Donacis*, Sacc., in Mich. ii. 352.

Accompanying it and intermingled with it on Thümen's specimens is *Gloniella microtheca*, Sacc. & Speg. (Syll. ii. 768), of which it is doubtless the pycnidial stage. (Fig. 6*a*.) In this connection it may be added that the "aparaphysatis (?)" of Saccardo in the description of this species of Pyrenomycete (*l.c.*) can have the "(?)" deleted: there are no paraphyses. The ascophores are on bleached patches, and the spermogones chiefly on the surrounding unbleached parts. The spermatia are subcylindrical, not "ellipsoid," often curved as in *Cytospora*, and measure about 4 × 1 μ. The connection between the spermogone and the ascophore is precisely similar to that between *Leptothyrium Hederae*, Starb. and *Hypoderma Hederae*, De Not., and between *Leptostroma virgultorum*, Sacc. and *Hypoderma virgultorum*, DC. *See* Journ. Bot. 1918, p. 319.

990. Phoma viridispora, *Cooke.*

PIROSTOMA VIRIDISPORUM, *Grove.*

Pycnidia roundish or (when mature) oblong, up to 1 mm. long, more or less aggregated, sometimes in longitudinal series, black, covered only by the cuticle, opening by a pore; texture of loose round dark cells, not compacted into a pseudoparenchyma. Spores fusoid, acute at both ends, eguttulate, greenish-olive, 9–11 × 2·5–3 μ; sporophores linear, as long as the spore. (Fig. 6*b*.)

On dry dead leaves of *Phormium tenax*, New Zealand (Herb. Cooke, *T. Kirk*, nos. 206 ! and 328 !).

The mycelium begins to grow in the epidermal cells which it destroys; the cuticle is at first raised in the centre, and forms a white spot in a black disc; afterwards it is burst open about the middle to form an irregular pore.

This fungus presents a considerable resemblance to *Pirostoma Farnetianum* Pollacci, on *Pandanus*. *See* Pollacci, in Atti Ist. Bot. Pavia, 1897, v. 195, pl. 7, figs. 11, 15, 16, and Sacc. Syll. xiv. 996.

FIG. 6.—*a*, Asci and spore of *Gloniella microtheca*, from Thümen's specimen on *Arundo Donax*; *b*, spores of *Pirostoma viridisporum*, from Kirk, no. 206; *c*, *Eriothyrium pelliculosum*, (1) pycnidium, showing margin and pore, × 180; (2) cells of margin; (3) spores and sporophores.

991. Phoma Phormii, *Sacc.*

Coniothyrium Phormium,* Cooke, in Grevill. 1879, vii. 96.

LEPTOTHYRIUM PHORMII, *Grove*.

Pycnidia densely aggregated, 200–300 μ diam., black, lens-shaped, subcuticular, raising the cuticle in a little ridge which at length splits away in various forms, mouthless, but the upper part at length disappearing. Spores very numerous, embedded in mucus, singly colourless, hardly coloured in mass, ovoid in face-view, oblong in profile, often more or less flattened, faintly guttulate, 3–4 × 1–2 μ; no sporophores visible. (Fig. 7.)

On dead leaves of *Phormium tenax*, in the Botanic Gardens, Brussels (specimens of *Phormium* stated to be in the University Herbarium, Edinburgh), Cooke, Herb. no. 71 !

This fungus resembles no. 990 (*Pirostoma viridisporum*) so closely in external appearance that one is tempted to regard it as an early stage of that species; the fabric of the pycnidium and its mode of origin are the same in both cases, but the obstacle to such a belief is that no intermediate forms of spores could be detected. At any rate it could be called a "forerunner," standing to the *Pirostoma* exactly as some species of *Phyllosticta* stand to *Phleospora* (*see* Journ. Bot. 1918, p. 206). The mycelium originates in the epidermal cells, fills them completely and destroys them; then, as the pycnidium grows, the cuticle is pushed up and cracked away from the subjacent layers of cells. The texture of the several-layered pycnidial wall is of loose small roundish dark-purplish-brown subopaque cells, very variable

* This should be taken as if printed "*Phormii*."

(5–10 μ) in diameter; these are not strongly coherent as in a typical *Phoma* pycnidium, but form a thickish irregular crumbly stratum, surrounding the spore-cavity on all sides, but thicker above and below than round the margin. They break apart easily on pressure, and behave much like the pycnidium of a *Phomopsis*, which latter, indeed, except for the fact that it arises beneath the epidermis, is more closely allied to the *Leptostromaceae* than to the *Sphaeropsidaceae*, though not exactly of either type.

Whether it is right to place the present species in *Leptothyrium* or in one of its allies cannot be decided until someone revises the *Leptostromaceae* according to modern notions, but it certainly falls within Saccardo's definition of the former and belongs to Diedicke's §D.

An imperfect state of the same fungus, labelled in Cooke's Herbarium "*Phoma phormicola*, Cooke," on dead *Phormium* (Kirk, no. 134 !), from Stewart Island, New Zealand, is in the same cover: but another small specimen (Kirk, no. 77 !) from New Zealand, also on dead *Phormium*, has a true pycnidium and *Cytospora*-like spores about 5 × 1 μ—this is labelled in Cooke's handwriting "*Phoma Phormii*, Cooke," and as it has no stroma, it may belong to that genus, but it is not = *Phoma Phormii*, Sacc.

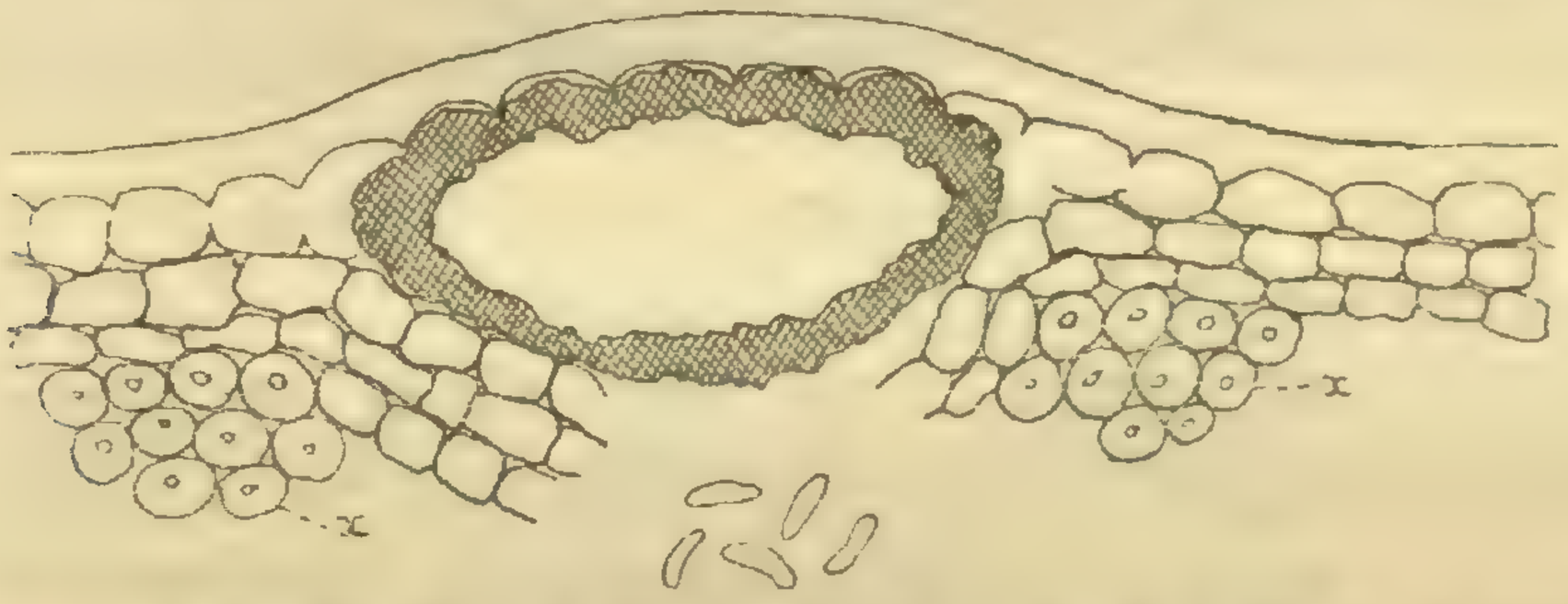

FIG. 7.—*Leptothyrium Phormii*, vertical section through a pycnidium, *in situ*, × 210; the cells marked *x* are the stone-cells of the mesophyll; below are shown five spores, × 600.

Strangely enough, I have lately received from Mr. D. A. Boyd some excellent specimens of this *Leptothyrium*, on decaying leaves of *Phormium tenax*, from Hunterston, Ayrshire, and Stranraer, Wigtonshire. Possibly the fungus accompanies the host wherever it is cultivated, just as *Coniothyrium concentricum* accompanies the species of *Yucca*; if so, it will be found in the plantations of *Phormium* which are beginning to be made in Ireland, but as it is only a saprophyte it may be of no economic importance.

The Scotch specimens agree perfectly as regards the pycnidia and spores with those from Brussels, but a curious feature seen in them is that some parts of the cuticle are broadly dyed of a pinkish-red colour. On searching for the cause of this, it was found that accompanying the *Leptothyrium* was a *Leptosphaeria*, the perithecia of which are larger and thicker than the pycnidia of the *Leptothyrium*, and are surrounded about the base by numerous creeping hyphal threads of a deep purplish red.

It would seem, on examination, that the colour is dissolved out of the hyphae, ? by rain, and tinges the cuticular layer just as "Soudan red" will do.

The description of the *Leptosphaeria* is as follows :—

LEPTOSPHAERIA PHORMII, sp. nov.

Perithecia circa 400 μ diam., lentiformia, atra, opaca, tecta, dein vertice erumpentia, basi hyphis purpurascentibus obsita; contextu crasso, parenchymatico, subpurpureo-brunneo. Asci elliptico-oblongi, apice rotundati, tenuissime tunicati, breviter pedicellati, 8-spori, paraphysibus parcis vel nullis cincti; sporidia biseriata, elliptica, 3-septata, ad septa subconstricta, 18–20 × 7–7·5 μ, loculis dilute fuscidulis.

In foliis emortuis *Phormii*, in Scotia (Boyd).

992. Phoma pelliculosa, *B. & Br.*

This is a curious species, belonging to the section Pycnothyrieae of the *Leptostromaceae*, and if a slight emendation be made it can be placed in Spegazzini's genus *Eriothyrium* (Sacc. Syll. x. 418). The only other known species of *Eriothyrium* (*E. dubiosum*, Speg. *l.c.*) differs in its fuliginous subiculum and its more ovoid spores. Whether the two are really congeneric or not, cannot be decided until more allied species are found.

ERIOTHYRIUM, Speg. emend.

Pycnidia minute, scutato-dimidiate, adnate, ostiolate, surrounded by an effused very thin smoky or fuscous-pallid subiculum. Spores hyaline, continuous, oblong or ovoid.

ERIOTHYRIUM PELLICULOSUM, *Grove.*

Pycnidia black, 50–100 μ diam., crowded, round, shield-shaped, dimidiate, applanato-convex, pierced by a wide central round or irregular impressed pore; texture of dark-brown cells, about 2–3 μ diam., distinctly radiating, especially at the margin. Spores narrow-oblong, straight or curvulous, about 3 × 1 μ; sporophores rod-shaped, up to three times as long, springing from the underside of the shield. (Fig. 6*c*.)

Under the cuticle of Bamboo stems, Peradeniya (B. & Br. Ceylon Fungi, no. 438 !).

The pycnidia have a similar texture to that of *Actinothecium caricicolum*, Ces. (Sacc. Syll. iii. 639). They consist of a thickish shield-shaped brown layer, lying on the destroyed epidermis, and formed of linear or ellipsoid cells distinctly radiating round the margin; this margin is, when untouched, continuous as in the simpler specimens of the *Actinothecium*, or as in *Actinothyrium*, *i.e.*, except for single projecting cells, it is not deeply indented, yet on the slightest pressure the shield splits into radiating sectors, though none of them were ever so deeply partite as the extreme forms in Cesati's figures in Hedwigia, i. 80, pl. 11, f. 3.

The pycnidia are immersed in, and at first covered by, a thin membranaceous subiculum which appears to be composed of densely interwoven pallid hyphae, adherent to the cuticle; at length the vertex of each shield emerges from the weft, splitting the cuticle and opening by a pore which gradually grows wider; ultimately the shield falls away entirely, leaving a little pit. The cells of the subiculum are thin-walled, very indistinct and tightly packed, forming a pseudoparenchyma, but occasionally the course of the separate radiating hyphae can be discerned, and in that case it reminds one of the thin peridium of the uredo-sori of a *Thecopsora*.

The mycelium appears to arise in the epidermal cells, which it ultimately destroys, leaving a layer of hyphae lying on the sclerenchymatous zone which underlies the epidermis, and separating easily therefrom. These hyphae leave the impression of the shape of their cells in the cuticle, and so that part of the cuticle beneath which the pycnidia are formed is seen to be "punctulate" with little roundish depressions. This gives it an appearance which makes a "contextus subanhistus punctulatus (non vere cellulosus)" like that which Saccardo falsely (in most cases at least) ascribes to the pycnidia of *Sacidium* (Syll. iii. 625). In all the cases that I have seen such a punctulate anhistous pycnidium is nothing but the darkened cuticle of the host, marked with the impressions of the subjacent fungous cells. This phenomenon can, of course, arise only where the fungous tissue is covered by the *cuticle* alone, as is usual in the *Leptostromaceae*. It may be noticed in passing, however, that some species of *Gloeosporium*, e.g. *G. Potentillae*, Oud. = *Marssonia Potentillae*, Fisch., have the pustules also covered only by the cuticle, so that this peculiarity is not confined to the *Leptostromaceae* and the *Melampsoraceae*.

995. Phoma Ammophilae, *Sacc.*

Perisporium Ammophilae, Dur. & Mont. Flor. Algér. p. 564.

The "*Perisporium*" is thus described by its authors:—

"P. emergens globosum minutissimum myriadeum atrum maculae cinereae insidens, sporidiis . . ." They add "Perithecia confertissima, 40–70 μ diam."

Jaap found on *Ammophila arenaria* in Schleswig-Holstein a fungus which he put down to this species; it had variable biguttulate spores about $5 \times 3\,\mu$, and caespitose sporophores about $25 \times 3\,\mu$. In this sense possibly *P. Ammophilae* (D. & M.) Sacc. may be upheld.

The specimens under this name, however, available for examination (Roum. Fung. Gall. Exs. no. 3562 !), on leaves and glumes of *A. arenaria*, from Algeria, showed two fungi. One of these is = *Sphaeropsis lugubris*, Bomm. Rouss. & Sacc. (Syll. x. 258); the spots on which it is seated answer to the description of Durieu and Montagne fairly well, but it cannot be their species because the pycnidia are larger and not crowded. The other,

not seated on grey spots, is = *Phoma nitida*, Rob. (*see* next species, no. 997, and fig. 8*b*), and if not identical with that of Jaap, of which no specimens have been seen, seems at any rate to be very similar to it; in that case they probably both belong to *Leptothyrium*. The question cannot be decided until better specimens are available.

997. Phoma nitida, *Rob.*

LEPTOTHYRIUM NITIDUM, *Grove.*

The specimen examined (Desm. Crypt. Fr. sér. 2, no. 355 !), on dry stems of *Calamagrostis arenaria*, has the spores of a *Phoma*, but as the pycnidium is very incomplete it should be placed in another genus. It has a thin dark pycnidial layer above, and a much softer and paler stratum below. Spores ovoid or ellipsoid, vacuolate in the middle, *i.e.*, with the protoplasm retracted to each extremity, 3–5 × 2–2·5 μ; sporophores crowded, subulate, very variable in length, averaging 10–12 μ long, often swollen below, *i.e.*, more or less ampulliform. (Fig. 8*b*.)

Each pycnidium forms a little convex, almost hemispherical, brownish-black and shining pustule, surrounded by a narrow halo which shades off gradually and is formed by brown hyphae. It is not a *Phomopsis*, and certainly not a *Phoma*, though its pycnidium seems to resemble that of *Phoma Cookei*, Pirotta = *P. Vitis*, Cooke, *non* Bon. Probably both these should be placed in the *Leptostromaceae*.

SPECIES PROBABLY TO BE LEFT IN PHOMA.

915. Phoma Siliquastrum, *Desm.*

Desmazières' own specimen (Crypt. Fr. sér. 1, no. 1874 ! possesses subcylindrical spores very similar to those of *Phoma oleracea*, Sacc., but the pycnidia are smaller and less black, approaching more to the texture of a *Phyllosticta*. They are intermediate between those of *P. oleracea* and those of *P. exigua*, Desm. on *Linum*, but do not exactly agree with either. The spores measure about 5 × 1 μ or less; the pycnidia occupy small olivaceous-brown patches, such as neither of the other two mentioned possesses.

On account of the spores they could not be referred to *Phoma nebulosa* (Pers.) Mont., as the patches of hyphae suggest, but there is evidence that the olivaceous crusts of such fungi, formed of brown hyphae creeping beneath the surface, are not always connected with the pycnidia. I have a specimen of *P. nebulosa*, (Pers.), on stems of *Angelica*, which illustrates this point most convincingly; the young pycnidia, surrounded by hyphae, but without spores, being more like *Phyllosticta*, while the mature ones, not surrounded by hyphae and full of spores, are those of a typical *Phoma*. The conclusion is that *P. Siliquastrum*, Desm. is only an accidental form of *P. oleracea*, Sacc., for the spores are the most persistent character of any species.

936. Phoma Pritchardiae, *Cooke & Hark.*

Pycnidia subgregarious, immersed, then erumpent, about 200 μ diam., black, shining, pierced by a pore. Spores narrowly cylindric-ellipsoid, obtusely rounded at both ends, continuous, biguttulate, about 10–12 $\times$ 2 μ (Cooke says 14 $\times$ 3 μ); sporophores subulate, about half as long again. (Fig. 8*a*.)

On *Pritchardia*, California (Cooke, Exs. no. 2167 !).

This species, which was described by Cooke in Grevill. 1884, xii. 93, might well be placed in a regenerated *Macrophoma*, if the futile limit of 15 μ were removed. Judging by the descriptions, the two varieties placed by Saccardo under this species—*coryphea* on *Corypha australis*, and *Phoenicis* on *Phoenix* (Sacc. Syll. x. 181)—do not seem to resemble *P. Pritchardiae* very much, but no specimens have been seen. *Phoma Phoenicis* is probably a *Phomopsis*, but *P. Pritchardiae* is not. *Phoma Coryphae*, Cooke (in Grevill. xix. 75), on Palm petioles, seems to be much nearer to the present species, but is very different in external appearance; unfortunately Cooke's specimen of *P. Coryphae*, on examination, yielded no spores.

937. Phoma Desmonci, *Rabenh.*

Pycnidia scattered or thinly gregarious, arranged mainly along the nerves, 300–450 μ diam., blackish, immersed, then erumpent by the extreme apex or simply raising the epidermis in a white spot, which is surrounded by a faint black stain. Spores cylindric-ovoid, straight or often curved, obtuse at both ends, hyaline, 5 $\times$ 1·5–2 μ.

On leaves of "*Desmoncus melanochaetes*" (= ? *Daemonorops melanochaetes*, Blume) in the Botanic Gardens, Calcutta. *See* Hedwigia, 1878, p. 60. The pycnidia of this species (Rabenh. Fung. Eur. no. 2454 !) are not described in Saccardo's *Sylloge*, vol. iii.

942. Phoma Ornithogali, *Thüm.*

Phoma Ornithogali, Thüm. in Flora, 1878, p. 358 (Thüm. Mycoth. Univ. no. 1783 !; Roum. Fung. Sel. Exs. no. 4749 !).

The description of Thümen (*l.c.*) is very correct, except that in one place, by error, the word "apice" is used instead of "basi"; for the spores are often subclavate; *i.e.*, rounded above, narrowed below, measuring 4–6 $\times$ 1·5–2 μ. This species might almost better be considered as a variety of *Phoma nebulosa*, Mont., which externally Roumeguère's specimens at least exactly resemble.

1008. Phoma chartarum, *Berk. & Curt.*

Phoma chartarum, B. & C. in Grevill. 1873, ii. 83.

Phoma charticola, Speg. Fung. Arg. Pug. no. 99 (1880). Sacc. Syll. iii. 168.

Pycnidia scattered, nearly superficial, subglobose, 90–120 μ diam., black; texture soft, thin, fuliginous-brown (truly *Phoma-*

like), with an impressed ostiole round which the tissue is darker. Spores oblong-ellipsoid, usually obtuse at both ends, often biguttulate, involved in mucus, perfectly hyaline, 4–4·5 × 2 μ. (Fig. 8*c*.)

On soft white paper, Alabama (Beaumont, Herb. Berk. no. 5106 !).

There can be no hesitation in deciding that Spegazzini's species is the same as that of Berkeley : the supposed difference in the size of the spores disappears on examination, and the delicate byssoid subiculum mentioned by Berkeley is not, now at least, apparent in his specimens.

But Cooke's British species (placed under the same name) is quite different. On examining his specimens (Cooke, Fung. Brit. Exs. no. 413 !) on millboard, London, 1875, one finds, in addition to a number of loose spores, a mixture of two forms. One is no doubt a Hyphomycetous stage of the other and, although not now specifically determinable, is obviously an *Aspergillus*. The other is a Pyrenomycete, belonging to the *Perisporieae*, and seems to be absolutely identical with *Cephalotheca Kriegeri*, Rehm (Ascom. Exs. fascic. 44, no. 1850, on white paper : *see* Annal. Mycol. 1909, vii. 405, and Sacc. Syll. xxii. 30). The only possibility of doubt lay in the fact that *no asci* could now be found, but the tendency of the spores to cling together in clusters (such as is known to all mycologists in *Eurotium herbariorum* and other species of that group) at once suggested that they had originally been contained in asci. The latter are known to be very diffluent in many of the *Perisporieae*, and their absence has often led to mistakes in description, as in Cooke's case here and also in Saccardo's *Mycogala parietinum* which is in most cases nothing but *Anixia* (*ascis praetervisis*). Though no specimens of Rehm's were at hand for comparison, the agreement of the British fungus with the account given in *Annales Mycologici* (*l.c.*), in every detail except those concerning the asci, leaves no loophole for hesitation.

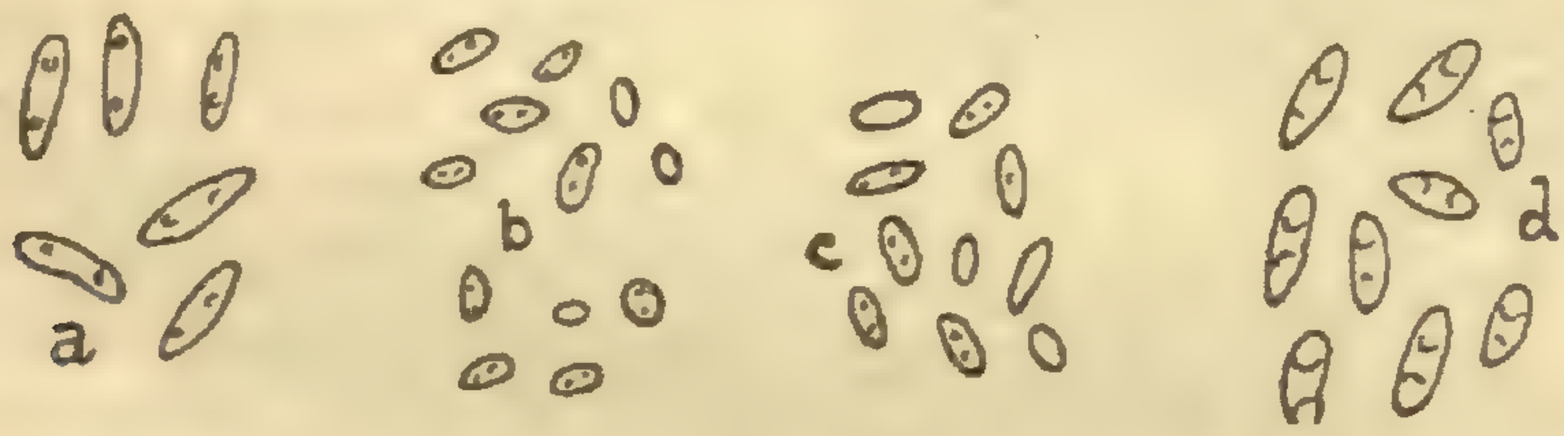

Fig 8.—*a*, *Phoma Pritchardiae*, spores; *b*, (upper group) spores from Desmazières' specimen, "*Phoma nitida*," no. 355, (lower group) spores from Roumeguère's specimen, "*Phoma Ammophilae*," no. 3562; *c*, *Phoma chartarum*, spores from Berkeley's specimen, no. 5106; *d*, *Phoma Andrachnes*, spores from Léveillé's specimens.

1012. Phoma Andrachnes, *Lév.*

(*See also* Sacc. Syll. Addit., p. 305.)

Two specimens, issued by Léveillé and named in his own handwriting, one in Herb. Hooker, the other in Herb. Berk.,

were examined, and from these the following description is drawn up :—

Pycnidia epiphyllous, scattered or in little crowded roundish groups, covered by the epidermis, then erumpent, globose, slightly papillate, at length collapsed, black, somewhat shining, 100–150 μ diam., pierced by an apical pore. Spores cylindrical, often curved, rounded at both ends (sausage-shaped), apparently biguttulate, quite colourless, $8 \cdot 5$–$9 \cdot 5 \times 2 \cdot 5\,\mu$; sporophores not seen. (Fig. 8*d*.)

On leaves of *Arbutus Andrachne*, Crimea.

The biguttulate appearance is due, not to the presence of oil-guttules, but to the fact that the protoplasm is retracted to each extremity of the spore, leaving the middle part as a vacuole. This species is similar to *Macrophoma maculiformis*, Sacc. = *Sphaeropsis maculiformis*, Cooke & Harkn., on *Arbutus Menziesii* (*see* Grevill. ix. 82), but has different spores.

After these may be placed a few species which are either indeterminable, or were merely named in error.

905. Phoma nyssocarpa, *Cooke*.

Phoma nyssaecarpa, Cooke, in Grevill. vii. 32.

There is a good supply of the pericarps of these fruits (*Nyssa capitata*), in Rav. Exs. no. 2133 !, covered with clusters of little brownish-black pycnidia (or perithecia), but no trace of spores of any kind could be obtained from them.

907. Phoma pomorum, *Thüm*.

There is no specimen of Thümen's in the Herbarium, but there are several others issued under this name, all of them showing hardly anything but young *Diplodia malorum*, Fckl.

941. Phoma Agapanthi, *Sacc*.

Sphaeropsis Agapanthi, Thüm. Contr. Myc. Lusit. no. 319.

Thümen's exsiccata (*legit* Moller), including the type specimen named in his own handwriting, show little but brown knots of mycelium, accompanied by a quantity of brown creeping threads and numerous loose spores : but no spores were seen attached to hyphae or in pycnidia. It is probably one of those species of *Cladosporium* which form a basal knot to the conidiophores.

945. Phoma macrothecia, *Thüm*.

Phoma macrothecia, Thüm. in Flora, 1876, p. 571 (Thüm. Mycoth. Univ. no. 680 !).

This is nothing but *Darluca*, parasitic on the uredo-sori of *Uredo Moraeae*, Kalch., on leaves of *Moraea grandiflora*, Eckl. = *Homeria collina*, Vent. var. γ, *ochroleuca*, Baker.

948. Phoma microscopica, *B. & Br.*

On Berkeley's original and only specimens of this there is a *Phoma*-like fungus to which it is at present impossible to assign a definite place. The pycnidia are scattered, subglobose, about 150 μ diam., covered by the discoloured epidermis which is darkened around the ostioles, pierced by a pore; texture thin, parenchymatous, pale-brown. Spores oblong-ellipsoid, rounded at the ends, often biguttulate, occasionally curved, hyaline, 7–8 × $2\frac{1}{2}$–3 μ.

On dying stems of *Potamogeton* (Herb. Berk. no. 44 !). It appears likely to be a young state of an *Ascochyta*, but no *Ascochyta* on *Potamogeton* seems to be recorded. It might be a *Phyllosticta*, but does not agree with those described on that host.

971. Phoma Musarum, *Cooke*, in Grevill, xii. 22.

There are a number of specimens of this, all named by Cooke (Ravenel, no. 3182 !, and Rav. & Cooke, Fung. Amer. Exs. no. 692 !). They consist of what are probably the beginnings of perithecia or pycnidia, but no spores corresponding to Cooke's description "elliptico-elongate, 10 × 3" could be detected.

993. Phoma linearis, *Sacc.*

Phoma lineata, Sacc. Syll. iii. 860.
Coniothyrium lineare, Thüm. Fung. Amer. Spec. no. 12.
All the specimens under this head, including :—
"*Coniothyrium lineare*, Thüm." (Ravenel, Fung. N. Amer. nos. 2810 !, 2925 !, and Harkness, no. 2212 !)
"*Phoma linearis*, Sacc." (Roum. Fung. Sel. Exs. no. 5767 !) seem to consist of nothing but either knots of mycelium, or young pycnidia or perithecia in which no spores were developed.

1016. Phoma Laricis, *Lév.* (*see* Syll. Addit., p. 306).

This is represented in the Herbarium by a specimen sent to Berkeley, and labelled in Léveillé's own handwriting "*Phoma Laricis*, Lév. in strobil. Laric. Europ.—Tauria."
It is not, however, on scales of Larch, but of *Picea excelsa*, and the examination of the fungus showed that it does not differ from *Sporonema strobilinum*, Desm.

1017. Phoma Podagrariae, *Westd.*

This, as is well-known, is nothing but a young undeveloped state of *Phyllachora Podagrariae*, Karst., and the specimens examined (Roum. Fung. Gall. Exs. no. 913 !) contain as a matter of fact numerous imperfectly formed asci. A reference to Westendorp's description (Bull. Acad. Roy. Belg. 1852) shows that he intended the same thing : but *Phoma Podagrariae*, Bres. is, of course, quite different.

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XVI.—THE COMPOSITION OF THE RHIZOMES OF BRACKEN AND ITS VARIATIONS.

James Hendrick.

During the latter part of the War, when it was necessary to ensure the food supplies of the country to the utmost extent and to examine all substances which were possible sources of food for human beings or live stock, or which might be used instead of food stuffs, for the production of alcohol, acetone and other necessary organic products, I made, under the auspices of the Ministry of Food, some investigations into the composition of the Rhizomes of Bracken, and into the supplies which were available, and the cost of obtaining these. It is well known that these Rhizomes contain considerable stores of starch, and that they have been, at various times and in different parts of the World, used as a source of food for men and animals. The

successful termination of the War a few months after the commencement of the enquiry made the food situation less critical and diminished the necessity for the enquiry, which was officially discontinued. Certain aspects of the results obtained have been dealt with elsewhere,* but in the course of the work some data were obtained which the late Professor Trail considered might be of interest to Botanists, and at his request the following note upon these was prepared.

The enquiry began early in the Spring of 1918, and it was the intention to take samples of the rhizomes at intervals throughout the year to ascertain the variation which took place in their composition with the season, and the best time of harvesting them from the food or starch-production point of view. Among others, samples were taken from two spots in Craibstone, the experimental farm of the College of the North of Scotland College of Agriculture. These two places are both in rough woodland and are within half a mile of one another. The first samples were taken at the beginning of April, and when they were analysed, it was found, that though the percentages of moisture and dry matter respectively were almost identical in the two, the percentage of nitrogen differed so seriously that at first it was supposed some mistake had been made. A repetition of the determination, however, showed that there really was a very great difference in the nitrogen content. The sample "A," taken on April 1st from the West woods had less than half the percentage of nitrogen contained in the sample "B," taken from the woods between Blue Breeks field and the Chapel Park (*see* Table I.), while on the other hand the percentage of soluble Carbohydrates in "A," was considerably greater than that in "B."

The analyses were made by the ordinary conventional methods used for feeding stuffs. The really significant determination is that of nitrogen, and "Albuminoids" are merely conventionally determined by multiplying nitrogen by $6\frac{1}{4}$. As the Soluble Carbohydrates are determined by difference they are necessarily less in sample "B" than in sample "A."

The next samples, A.2 and B.2, were drawn two months later, on the 7th June, when the fronds had developed considerably, and thereafter samples were taken at intervals of a month, or a little more, till March 1919. In all, 10 samples were drawn from each place, and the results of the analyses of these are given in Table I.

The samples are numbered in the Table, and the dates on which the samples were taken were as follows:—No. 3 on July 18th, No. 4 on August 21st, No. 5 on September 25th, No. 6 on October 28th, No. 7 on November 30th, No. 8 on December 27th; all in 1918; No. 9 on February 4th and No. 10 on March 8th in 1919. In all cases the A. and B. samples were collected on the same date.

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* "Bracken Rhizomes and their Food Value," Trans. Highland & Agricultural Society of Scotland, 1919, xxxi., 5th series, pp. 227–236.

Table 1.—Composition of Bracken Rhizomes.

	"A" Samples.										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Av.
	%	%	%	%	%	%	%	%	%	%	%
Moisture - - - - - -	74·60	78·71	76·32	72·89	64·93	71·66	69·87	62·61	70·15	69·24	71·10
Composition of Dry Matter:											
Ether Extract - - - -	1·02	·80	1·21	·70	·68	·70	·73	·74	·74	·84	·82
* Albuminoids - - - - -	8·62	4·73	1·84	6·23	6·24	1·87	1·88	2·86	1·82	5·69	4·18
Soluble Carbohydrates - - -	65·52	58·78	57·01	67·96	68·68	71·82	68·44	71·67	72·25	62·79	66·49
Fibre - - - - - - -	17·52	27·36	27·44	18·11	18·79	18·80	22·28	20·00	19·46	26·17	21·59
† Ash - - - - - - -	7·32	8·33	12·50	7·00	5·61	6·81	6·67	4·73	5·73	4·51	6·92
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing Total Nitrogen - -	1·37	·76	·29	·99	·99	·30	·30	·45	·29	·91	·66
„ Protein Nitrogen - -	·87	·70	·29	·88	·91	·22	·23	·37	·22	·75	·54
† „ Siliceous Matter - -	3·86	3·68	9·24	2·21	2·34	3·88	3·17	1·71	2·75	1·46	3·43
Ash, less Siliceous Matter - -	3·46	4·65	3·26	4·79	3·27	2·93	3·50	3·02	2·98	3·05	3·49

TABLE I.—*continued.*

	"B" SAMPLES.										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Av.
	%	%	%	%	%	%	%	%	%	%	%
Moisture - - - - - -	74·72	78·18	73·35	74·83	65·01	66·65	68·02	64·45	68·03	68·68	70·19
COMPOSITION OF DRY MATTER:											
Ether Extract - - - -	·95	1·33	·72	1·07	·88	·71	·75	·78	·75	·80	·87
* Albuminoids - - - - -	21·19	18·39	7·54	13·66	11·80	11·75	12·13	12·32	11·78	12·38	13·29
Soluble Carbohydrates - - -	48·30	43·62	50·12	58·86	66·92	58·43	61·39	60·97	59·73	56 62	56·51
Fibre - - - - - - -	20·26	28·23	27·71	19·30	14·40	18·74	19·35	18·90	18·89	21·07	20·68
† Ash - - - - - - -	9·30	8·43	13·91	7·11	6·00	10·37	6·38	7·03	8·85	9·13	8·65
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing Total Nitrogen - -	3·39	2·94	1·21	2·18	1·88	1·88	1·94	1·97	1·87	1·97	2·12
„ Protein Nitrogen - -	2·88	2·40	1·16	1·94	1·51	1·74	1·79	1·82	1·72	1·66	1·86
† „ Siliceous Matter - -	5·42	4·25	10·00	2·10	3·57	6·95	3·28	4·05	5·41	5·77	5·08
Ash, less Siliceous Matter - -	3·88	4·18	3·91	5·01	2·43	3·42	3·10	2·98	3·44	3·36	3·57

The Table gives first the moisture found in each sample in its fresh state as it was taken from the ground. The rest of the constituents are calculated on the dry, moisture-free Rhizomes. The average composition of the ten "A" samples and of the ten "B" samples is given. The great difference between the two sets of samples is in the Nitrogen, and, consequently, in the Albuminoids.

In the ten "B" samples the average Nitrogen is 0·62 per cent., or calculated in the dry matter 2·12 per cent., while in the ten "A" samples the Nitrogen is 0·19 per cent., or, calculated in the dry matter, 0·66 per cent. The Nitrogen, therefore, in the "B" samples is more than three times as great as in the "A" samples. The difference, too, is found in every individual pair of samples, though in the samples taken in September the one is only about twice as great as the other, while in the samples taken in November and February the difference between them is nearly as 8 to 1.

During the first few months of sampling, the variations in both sets of samples were very much what was expected. With the development of the fronds, the store of Nitrogen in the Rhizomes diminished seriously, and the percentage in both "A" and "B" reached a minimum in July, when the frond reached its maximum development. After that, the Nitrogen increased again and soon reached a maximum. Having developed its frond, the plant appears to build up again quickly its store of nitrogenous material in the Rhizomes. This has a bearing on the important economic problem of the best time to cut bracken, when it is desired to rid land of it. The nitrogen content of the Rhizome appears to be at its lowest just when the frond is fully developed, and if cut then, the Rhizome will be left with very limited supplies of nitrogenous materials.

In both "A" and "B" the new maximum percentage of Nitrogen in the dry matter is reached in August. After that, the percentage in the "B" samples falls a little, but remains as nearly constant throughout the late autumn and winter as could be expected in a number of different samples such as these. The small diminution of the percentage of Nitrogen in the late summer might easily be accounted for by the increase in Carbohydrates due to the Carbohydrate deposition at that time being proportionately greater than that of nitrogenous material. But it is more difficult to account for the great falling off in the nitrogen percentage in the "A" samples. In February the percentage is exactly the same as the minimum in July, and in October and November it is very little greater, but there is this noticeable difference, that whereas in July the Nitrogen was all Protein Nitrogen, in all the other months there is a very appreciable proportion of non-protein Nitrogen present.

A somewhat similar phenomenon is to be noted in the "B" samples in which the non-protein Nitrogen is much lower in July than at any other period of the year. The percentage of Nitrogen in the "A" samples varies widely from month to

month in a fashion for which I am unable to offer any explanation. For instance, it is practically 1 per cent. of the dry matter in August and September, but falls to 0·3 per cent. in October and November, rises somewhat in December but falls again in February, only to rise again suddenly to nearly 1 per cent. in March. All these figures were fully confirmed. The only suggestion I can make is that in the low Nitrogen "A" samples there were great variations in the Nitrogen content from spot to spot. But the whole of the samples were in each case taken from an area of about 12 square yards, and each sample consisted of practically all the pieces of Rhizome found in an area of about a square yard.

It is to be noted that in both the "A" and "B" samples the percentage of Nitrogen found at the beginning of the growing season in early April 1918 was considerably higher than that found in any other sample at any time of year. The samples taken nearly a year later in early March 1919 did not in either case contain nearly so high a percentage of Nitrogen. This may have been an effect of season. The outstanding difference between the two sets of samples is the radical difference between the percentage of Nitrogen all through the season. There are no great differences in other aspects. The moisture in the two sets of samples is very similar and varies somewhat similarly during the season. In both it increases from April to June, falls throughout the summer, then rises slightly and falls again to its minimum in December and again rises considerably in February and March.

The "Soluble Carbohydrates" also vary somewhat similarly in both with the season, though for the reason already stated they are always lower in the "B" samples, which are rich in nitrogeous matter, than in the "A" samples. As might be expected, they fall to a minimum in June, then increase throughout the summer when the frond has developed and carbon assimilation is active. The fibre also varies on somewhat similar lines in the two series of samples throughout the season, and is on the average nearly the same in the two. The Ash is made up of two parts, the genuine Ash of the rhizomes, and siliceous matter derived from the soil which is accidently present. If we deduct this siliceous matter, the average ash in each of the sets of samples amounts to almost exactly 1 per cent. of the original rhizomes or $3\frac{1}{2}$ per cent. of the dry matter, and though it varies somewhat irregularly from month to month it exhibits no features calling for special mention. The "Ether Extract" also, which amounts on the average to between ·8 and ·9 per cent. in both sets of samples, shows no special features calling for comment. Why then should the Nitrogen content exhibit such a remarkable difference?

The late Professor Trail examined both the rhizomes and fronds and reported that he could find no botanical differences between the bracken growing at the two places and that both

appeared to be normal *Pteris aquilina*. This disposed of a suspicion which had occurred to me that I might be dealing with two different species or varieties.

Analyses were also made of the fronds at different periods during the summer and autumn, and the results are given in Table II.

The fronds developed later at "A," the West Woods, than at "B," the wood between the Chapel Park and Blue Breeks. The first samples from "B," No. 1 in the Table, were gathered on May 9th when they were from 2 to 12 in. high and just beginning to uncurl. The corresponding samples from "A" were not taken till three weeks later, May 30th, and were even then only about 6 in. high and still curled. Both are high in moisture and relatively high in Nitrogen, and at this stage the Nitrogen is higher in the "A" sample than in the "B" sample.

The next samples were taken on June 18th, No. 2 in the Table, when the fronds at both places ranged up to 3 ft. in length. Those at "B" however were larger and better developed than those at "A," which were relatively small and narrow. The "B" fronds were at this time considerably richer in Nitrogen and they also contained a distinctly higher percentage of moisture. It is noticeable that at this stage the non-protein Nitrogen is lower than at any other. This was an unexpected result, as, judging from general experience with Plant Analysis, one expected the proportion of non-protein Nitrogen to be considerable in an immature leaf.

The next samples were taken on September 25th, when the fronds were turning yellow. Those at "A" were already almost completely yellow, while those at "B" were only yellow here and there. Though the "A" fronds developed later, they turned yellow earlier. The two places are at nearly the same altitude, about 300 ft. above sea level, but "A" is more exposed than "B," which is well sheltered.

In these samples there is a great difference in Nitrogen, and the "A" sample is again considerably lower in percentage of moisture than the "B" sample. In both cases the proportion of non-protein Nitrogen is greater than in any of the other samples.

The final samples were taken on October 28th when the fronds were dead and brown at both places. The difference in Nitrogen persists in these dead fronds, those from "B" having almost exactly twice the percentage which was found in those from "A."

Except the differences in Nitrogen and moisture, no other striking dissimilarity was found between the two sets of samples, and the fronds therefore, after they are developed, exhibit much the same peculiarity as the rhizomes, in that those from "B" are much richer in nitrogenous matter than those from "A."

Samples of the soil were taken from both places to see if they exhibited any remarkable differences in Nitrogen content, or otherwise, which might throw light on the differences found in the

Table II.—Composition of Bracken Fronds.

	"A" Samples.				"B" Samples.			
	1.	2.	3.	4.	1.	2.	3.	4.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	90·39	69·55	62·90	19·20	90·23	74·27	70·27	18·42
Composition of Dry Matter.								
Ether Extract	2·39	3·14	2·53	1·69	2·94	4·33	2·45	1·97
* Albuminoids	27·73	15·59	3·37	3·40	25·15	21·58	7·56	6·74
Soluble Carbohydrates	41·09	50·35	52·38	44·34	44·76	46·29	48·62	42·46
Fibre	13·17	24·50	34·66	44·34	15·86	20·66	33·97	42·88
† Ash	15·62	6·42	7·06	4·65	11·29	7·14	7·40	5·95
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing Total Nitrogen	4·44	2·48	·54	·54	3·99	3·46	1·21	1·07
Containing Protein Nitrogen	3·69	2·43	·38	·45	3·58	3·42	·90	·91
† Containing Siliceous Matter	·73	·52	2·83	2·69	1·08	·43	1·85	2·30

bracken. Both soils are typical sour, moorish soils, and the results of their partial analysis are shown in Table III.

TABLE III.—PARTIAL ANALYSIS OF SOILS.

	"A."	"B."
	West Woods.	Wood between Blue Breeks Field and Chapel Park.
	Per cent.	Per cent.
Loss on Ignition (Humus, etc.) -	42·65	26·85
Total Nitrogen - - - -	·55	·57
Nitrogen as Nitrate - -	absent	absent
Nitrogen as Ammonia - - -	·001	·001
Lime Requirement, as $CaCO_3$ - -	1·53	1·30

The soil from "A" was nearly free from stones and gravel. The coarse materials which failed to pass a sieve with round holes 1 millimetre in diameter were less than 2 per cent. On the other hand, the soil from "B" was stoney, and almost 29 per cent. of the sample consisted of stones and gravel which failed to pass the 1 mm. sieve. The determinations shown in Table III. were made in the fine earth which passed this sieve. Both soils were found to be very sour. By Truog's test, both gave an acidity comparable to that of a pure peat, but "A" was found to be distinctly more acid than "B." On the other hand, the determination of "Lime Requirement" by Hutchinson & Maclennans* method (*see* Table III.) shows that it requires more Carbonate of Lime to neutralise "B" than "A," but it also shows that both are very sour soils. An ordinary soil will weigh, dry, approximately 1,000 tons per acre to a depth of 9 in., and for a soil of this weight the figures mean that it would require 15·3 tons of Carbonate of Lime to neutralise "A" and 13·0 tons to neutralise "B." Such quantities are never applied now-a-days in agricultural practice, but, on the other hand, such moorish soils as these weigh light, and would not have a dry weight of 1,000 tons per acre 9 in. deep. Little information is to be gained from the figures for total Nitrogen, as both soils contain almost the same percentage, and that much what might be expected from soils of this class.

Finally there is the difference in situation of the two places. "A" is on an open hillside from which the trees were removed some time ago, and it is therefore exposed and free from shade. "B" on the other hand is a well sheltered hollow, where the Bracken is both sheltered from wind and shaded by trees. In

* Journal of Agricultural Science, 1915, vii. pp. 75–105.

this shaded hollow the Bracken grows more luxuriantly than at "A." The fronds grow larger, and are broader and more vigorous. In the more exposed situation at "A" the Bracken grows vigorously, but, as already stated, the fronds come later and go earlier, and they are somewhat smaller and distinctly narrower and harder than at "B." This difference in situation is the only real difference which has been found which I can suggest as the cause of the difference in composition found in the plants taken from the two places, and it hardly appears to be a satisfactory explanation for so remarkable a difference in Nitrogen content.

XVII.—DATURICARPA, A NEW GENUS OF APOCYNACEAE.

O. Stapf.

A few months ago Dr. E. De Wildeman submitted to me for examination some material of Apocynaceous plants which had accumulated in the Herbarium at Brussels during recent years, being found unreducible to any described genus of the family. The structure of the fruit showed undoubtedly novel characters. The habitus and general aspect of the flowers pointed to *Tabernanthe* and *Pterotaberna*, but the structure of the anthers differed essentially from that obtaining in either genus and was practically the same as in *Carvalhoa*, from which it differs, however, in the corolla and to some extent in the habitus. There are three and possibly four species discernible, all closely allied and forming together a well defined and homogeneous group which may be proposed as a new and distinct genus, *Daturicarpa*, a name which speaks for itself.

Daturicarpa, *Stapf*, gen. nov. (Apocynaceae—Tabernaemontaneae); affinis *Carvalhoae*, K. Schum., sed corolla plane hypocraterimorpha, antherarum connectivo basi antice calloso piloso, praecipue vero mericarpiis bacciformibus undique verrucis vel spinis mollibus obtectis distincta.

Calyx parvula, herbacea, intus eglandulosa (vel interdum pauciglandulosa ?); sepala 5, sublibera, imbricata, ovata, eciliata. *Corolla* hypocraterimorpha; tubus basi leviter ampliatus, e medio sursum sensim angustatus, ore exappendiculatus, intus pone antheras lineis pilosis singulis notatus; lobi latiusculi, obtusi, sinistrorsum contorti, in alabastro haud inflexi. *Stamina* medio tubo inserta; antherae in conum conniventes, in tubo inclusae, stigmati haud vel vix agglutinatae, lineari-sagittatae, acuminatae, caudis longiusculis incurvis acutis, dorso glabrae, connectivo ima basi postice ac antice calloso et hic laxe piloso, thecarum parte pollinifera parti sterili laevi fere aequali. *Discus* indistinctus, ovario adnatus, carnosulus. *Carpella* 2, basi excepta libera, sensum in stylum filiformem abeuntia; stigma capitatum, breviter apiculatum, basi anguste manicatum, leviter 5-sulcatum,

FIG. I.

Daturicarpa lanceolata.

FIG. II.

1–4, Daturicarpa elliptica, 5–9, D. firmula.

subviscosum; ovula 3–5-seriata. *Mericarpia* quorum unum saepe hebetatum vel abortivum, indehiscentia, bacciformia, globosa vel subglobosa, undique verrucis elongatis vel spinis mollibus obtecta (more *Daturae*, unde nomen), cortice subcoriaceo et tunc interdum crasso, raro tenui. *Semina* ad 20 (rarius plura), ellipsoidea in pulpa mucilaginosa nidulantia; testa crassiuscula, spongioso-coriacea, longitudinaliter costata costis transverse rugulosis; endospermium ruminatum, subosseum. *Embryo* cotyledonibus radiculae subaequilongis planis latis.—Frutices vel arbusculae latescentes, glaberrimae, furcato-ramosae, ramis annotinis cortice pallido laevi vel verrucoso et rugoso-striato. Folia opposita, papyracea, laxe nervosa, breviter petiolata; petioli ramis basi acute triangulari insidentes, intus glandulis numerosis stipati. Flores in paniculas sparsifloras breves e furcis ramorum junioribus ortas dispositi, parvuli albidi vel viridi-flavescentes, tubo 6–7 mm. longo, limbo aperto 7–8 mm. diametro. Fructus ochracei vel aurantiaci vel atro-virescentes, plerumque unus inflorescentiae ad maturitatem perveniens axi indurato ramulum referente suffultus.

Species 3–4, omnes Congolensis.

Folia tenuia :

Folia saturate viridia, lanceolata, longe sensim acuminata, acumine acuto, 10–15 cm. longa, 2·5–5 cm. lata, nervis lateralibus utrinque circiter 7; rami plerumque laeves; mericarpia ellipsoideo-globosa, 2·5 cm. longa, atro-olivacea, cortice mediocri ... ... 1. *D. lanceolata.*

Folia pallide viridia (praesertim subtus), late elliptica vel elliptico-oblonga, abrupte caudato-acuminata, acumine lineari obtusiculo, 10–18 cm. longa, 5·5–7 cm. lata, nervis lateralibus utrinque 6–7; rami rugoso-striati et lenticellato-verrucosi, mericarpia globosa, 3·5 cm. diametro, aurantiaca, cortice crasso ... 2. *D. elliptica.*

Folia firmula, lanceolata, 5–10 cm. longa, 1·5–3·5 cm. lata, nervis lateralibus utrinque 5; rami rugoso-striati et lenticellato-verrucosi; mericarpia circiter 2 cm. diametro, atro-olivacea, cortice mediocri 3. *D. firmula.*

EXPLANATION OF TEXT FIGURES I. & II.

I. *D. lanceolata*; 1, part of branch with a pair of leaves and an inflorescence x. 1; 2, flower, x. 5; 3, calyx flattened out, x. 10; 4, corolla tube, longitudinal section, x. 5; 5, stamen, x. 16; 6, pistil, x. 5; 7, a carpel in transverse section, x. 20; 8, a pair of fruits, only one follicle developed in each case, x. 1; 9, fruit, cut open, x. 1; 10, seed, x. 4; 11, same in longitudinal section. II. 1–4, *D. elliptica*: 1, leaf, x. 1; 2, fruit with unequal follicles (note the short stipes above the calyx)' x. 1; 3, seed, x. 4; 4, seed in longitudinal section, x. 4; 5–9, *D. firmula*: 5, pair of leaves, x. 1; 6, fruit (mericarp), x. 1; 7, same, cut open, x. 1; 8, seed, x. 4; 9, same in longitudinal section.

1. **D. lanceolata,** *Stapf* (sp. nov.). *Frutex* ramis annotinis laevibus vel sublaevibus, rarius hinc inde lenticelloso-verrucosis. *Folia* lanceolata, longe acute acuminata, basi acuta, pleraque 10–15 cm. longa, 2·5–5 cm. lata, tenuiter papyracea, exsiccando supra saturate viridia, subtus pallidiora, nervis lateralibus utrinque circiter 7; petioli circiter 7 mm. longi, basibus oppositorum lateraliter haud obviis linea prominula transversa junctis. *Paniculae* .pedunculo 1–2 cm. longo incluso ad 4 cm. longae. *Sepala* late ovata, acuta, interdum sub-denticulata. *Corolla* albida. *Mericarpia* ellipsoideo-globosa, pedunculo recurvo vel pendulo ad 4 cm. longo suffulta, atro-olivacea, spinis mollibus 5–7 mm. longis creberrimis tecta, cortice 1–2 mm. crasso, spinis 5–7 mm. longis. *Semina* probabiliter ultra 10, 5–6 mm. longa.

BELGIAN CONGO.—Province Orientale; near Stanleyville on wooded river banks, *Bequaert*, 7058.

2. **D. elliptica,** *Stapf* (sp. nov.). *Frutex* vel arbuscula, ramis annotinis crebre rugoso-striatis et lenticellato-verrucosis. *Folia* late elliptica vel elliptico-oblonga, abrupte caudato-acuminata acumine lineari obtusiculo, 10–18 cm. longa, 5·5–7 cm. lata, admodum tenuia, supra viridia vel exsiccando fuscescentia, subtus pallida, nervis lateralibus utrinque 6–7; petioli 3–6 mm. longi, basibus oppositorum lateraliter plerumque sub angulo acuto obviis. *Paniculae* pedunculo circiter 5 mm. longo incluso ad 3 cm. longae. *Sepala* ovato-rotundata, obtusa vel subobtusa. *Corolla* viridi-flavescens ore rubro-striata. *Mericarpia* pedunculo 1–2 cm. longo patulo vel erecto suffulta, globosa, ad 3·5 cm. diametro, rubro-ochrea vel aurantiaca, spinis mollibus 7–10 mm. longis creberrimis tecta, cortice 3 mm. crasso. *Semina* ad 20, 7–9 mm. longa.

BELGIAN CONGO.—Kwango District; Kikwit, *Vanderyst*, 3044. Equateur, Mondombe, Nov. 1917, *Jespersen*. Province Orientale; in virgin forest near Lubutu-Kirundu, *Bequaert*, 6843. Kasai District; Batempa, *Lescrauvaet*, 353; Kondue, *E. & M. Laurent*, 17. .

3. **D. firmula,** *Stapf* (sp. nov.). *Frutex* ramis annotinis arcte rugoso-striatis, lenticellato-verrucosis. *Folia* lanceolata, acute vel subobtuse acuminata, basi acuta, pleraque 5–10 cm. longa, 1·5–3·5 cm. lata, firmule papyracea, exsiccando supra atrofusca, subtus fusco-viridia, nervis utrinque circiter 5; petioli 2–4 mm. longi, basibus oppositorum lateraliter sub angulo acuto magis minusve obviis. *Paniculae* pedunculo 1 cm. longo incluso ad 2·5 longae. *Sepala* rotundato-ovata, obscure denticulata, obtusa. *Corolla* colore ignoto, exsiccando flavescens; *Mericarpia* pedunculo 2 cm. longo recurvo suffulta, fusco vel atro-olivacea, globosa, 2 cm. diametro, spinis mollibus brevibus (2–3 mm. longis) crebris tecta, cortice vix 2 mm. crasso. *Semina*, ut videtur, circiter 10, 6–8 mm. longa.

BELGIAN CONGO.—Equateur; Moma, *Jespersen*.

A specimen collected by Claussen in the neighbourhood of Bombaie near Lusambo (?) also belongs here, but the capsule attached contains fruits with a thick shell like those of *D. elliptica* and several leaves of *D. firmula* as well as a fragment of a leaf of *D. elliptica.*

A further species, characterised by small mericarps (not quite 2 cm. in diameter) with a thin, in the dry state, transparent cortex, seems to be represented by a specimen collected by E. Laurent by the Sankuru river in December 1895.

He describes it as a small tree. There are no flowers with it, but a fragment of an infructescence is attached to the stem. This seems to have borne two fruits and its axes are much less lignified than those of the other species. The leaves are very thin, oblong to lanceolate-oblong and caudate-acuminate, gradually attenuated at the base and 8–12 cm. by 3–4·5 cm., with a petiole about 1 cm. long.

XVIII.—MISCELLANEOUS NOTES.

Mr. O. T. Faulkner, B.A., Dip. Agric. (Camb.), late Deputy Director of Agriculture, Lyallpur, Punjab, India, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Director of Agriculture, Nigeria, and Mr. R. Swainson-Hall, F.L.S., who has spent some years on plantations in the Portuguese Congo, Mr. H. B. Waters, B.A. (Oxon.), Mr. H. Roebuck, N.D.A. (Leeds) and Mr. J. M. Lonsdale, who has had previous agricultural experience in India, as Agricultural Superintendents in the Department of Agriculture, Nigeria.

The following appointments in the Agricultural Department of the Gold Coast have been made by the Secretary of State for the Colonies, on the recommendation of Kew :—

Lt.-Col. A. Ogilvie, N.D.A. (Edin.) and Mr. C. H. Knowles, Superintendent of Agriculture, Fiji, Senior Superintendents of Agriculture.

Mr. H. J. Horwood, B.A. (Oxon.), Mr. A. W. Paterson, N.D.A. (Edin.) and Mr. J. Steele, N.D.A., Assistant Superintendents of Agriculture.

Mr. M. Vardy, Assistant Superintendent of Agriculture, Grenada (see *K.B.* 1920, p. 71) and Mr. A. A. L. Smith of the Royal Botanic Gardens, Edinburgh, Supervisors of Fruit and Vegetable Farms.

Mr. T. D. Maitland, Chief of the Economic Plants Division, Kenya, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Botanist in the Agricultural Department, Uganda.

Mr. C. C. T. Sharpe, of the Imperial College of Science and Technology, has been appointed by the Secretary of State for the Colonies on the recommendation of Kew, Plant Import Inspector, Kenya Colony, and Mr. F. B. Booker, a Field Assistant, attached to the Laboratories of the Chemical Research Department.

Mr. B. G. C. Bolland, B.A. & Dip. Agric. (Camb.), lately Botanist in the Ministry of Agriculture, Egypt, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Director of the Amani Institute, Tanganyika Territory.

Mr. E. Brand, Mr. A. E. Haarer, Mr. R. J. Lathbury, B.A., and Mr. A. Pitcairn, N.D.A. (Edin.) have been appointed District Agricultural Officers in the Department of Agriculture, Tanganyika Territory.

Miss E. J. Welsford, M.B.E., F.L.S., has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, as Mycologist to the Agricultural Department, Zanzibar, and Mr. Graham Tomson has been appointed Inspector of Plantations.

Mr. F. J. Cook, a member of the gardening staff of the Royal Botanic Gardens, has been appointed Assistant Gardener at the National Botanic Gardens, Kirstenbosch, S. Africa.

Mr. H. O. Iliffe, B.A. & Dipl. Agric. (Camb.), has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Economic Botanist in the Department of Agriculture, Ceylon.

The following appointments in the Straits Settlements and in the Agricultural Department of the Federated Malay States have been made by the Secretary of State for the Colonies, on the recommendation of Kew :—

Mr. G. A. Best, a member of the gardening staff of the Royal Botanic Gardens, Assistant Curator of the Botanic Gardens, Singapore, and Mr. J. Fairweather, N.D.A. (Leeds) an Assistant Agricultural Inspector, Straits Settlements.

Mr. F. R. Mason, Dipl. Agric., as Assistant Mycologist, Mr. M. R. Henderson, B.Sc. (Aberdeen), as Systematic Botanist, Mr. A. A. Campbell, B.Sc. (Edin.), Mr. J. L. Minto & Mr. G. E. Mann as Assistant Agricultural Inspectors and Mr. E. Farquharson, N.D.A., an Assistant Agriculturist, Federated Malay States.

War Memorial to Kew Employees.—On Wednesday, May 25, a Memorial to the men of the Royal Botanic Gardens, Kew,

who lost their lives during the late war, was unveiled by the Director. It is erected on the back wall of the Temple of Arethusa, between the Victoria Gate and Museum No. 1, and takes the form of a three-panelled tablet in bronze designed and executed by Sir Robert Lorimer, A.R.A.

The idea of erecting such a tribute originated with the Kew Guild, an association of past and present members of the technical and administrative staff of the Gardens. Other members of the Gardens' staff, who are not qualified for membership of the Guild, wishing to join issue, the Memorial became the general token of honour to their dead comrades of the whole staff and of past and present Student Gardeners.

At the head of the central panel, immediately below a crown and scroll, are the words "To the Glory of God, and the Honour and Memory of the Members of the Kew Guild and Staff of the Royal Botanic Gardens, who gave their lives in the War—1914–1919," whilst at the base are the words "Floreat Kew," the motto of the Kew Guild.

On the three panels are enumerated the following 37 names of men, some of whom left Kew direct to join H.M. Forces, whilst others either hurried home from distant Colonies and Foreign Countries to join home contingents, or threw in their lot with the Armies of their adopted countries :—

L./Cpl.	Charles Henry Anderson, A.M.	London Scottish.
Private	Arthur Edwin Baggs ...	Canadian Seaforth Highlanders.
,,	Charles Frederick Ball ...	Royal Dublin Fusiliers.
2nd/Lt.	John Charles Beswick ...	Royal Lancaster Regiment.
Private	Charles Hubert Brown	Royal Garrison Artillery.
,,	John Mackenzie Campbell	Canadian Beavers Battalion.
Gunner	James William Clark ...	Royal Marine Artillery.
Sergt.	Sidney George Cobbold ...	Rifle Brigade.
L./Cpl.	Harry Sydney Cockcroft ...	Military Foot Police.
Private	Ernest Richard Collins ...	Middlesex Regiment.
,,	Sidney George Comer ...	Tank Corps, U.S.A.
Sergt.	John Dear	East Surrey Regiment.
Capt.	Charles Leopold Digoy, Ch. Leg. Hon., Rus. Cross, St. Ann	French Infantry.
Rifl.	John Divers	Queen Victoria Rifles.
Sergt.	George Douglas	Tank Corps.
L./Cpl.	Arnold Edmund Duley, M.M.	Somerset Light Infantry.
Private	Gordon Farries	Argyll & Suth. Highlanders.
,,	James Garnett	Wiltshire Regiment.
Sergt.	John Giles	Canadian Victoria Fusiliers.
Private	Joseph Hayhurst	Border Regiment.
Sergt.	Frederick Honey	East Surrey Regiment.

Seaman	John Knowles Jackson	...	Royal Navy.
Private	William Lorimer Joyce	...	South Wales Borderers.
,,	Henry James Longhurst	...	Kings Royal Rifles.
Pioneer	Percy Thomas Martin	...	Royal Engineers.
Rifl.	Arthur John Meads ...	...	Queen's Westminsters.
Private	Walter Henry Morland	...	Royal Scots.
Gunner	Frederick T. Purssell	...	Royal Field Artillery.
2nd/Lt.	Munro Briggs Scott ...	...	Royal Scots.
Gunner	Robert Service ...	...	Canadian French Mortar Brigade.
Sergt.	Henry James Smith ...	...	East Surrey Regiment.
,,	Herbert William L. Southgate		Norfolk Regiment.
Major	John Leonard Veitch, M.C....		Devon Regiment.
L./Cpl.	Frank Windebank ...	...	East Surrey Regiment.
Sign.	John Nicholls Winn ...	...	Civil Service Rifles.
Cpl.	Herbert Martin Woolley	...	Essex Regiment.
Private	Albert Wright ...	...	Warwickshire Regiment.

These men belonged to all ranks from the scientific to the labourer staff, but the percentage of the advanced Student Gardener is singularly heavy. Of this class, ten were Sub-foremen; all joined the Colours but five only lived to return. Where so many men nobly gave their all, it may seem invidious to single out one name for special mention, were it not felt that his dead comrades would have been the first to wish it in the case of L./Cpl. Charles Henry Anderson, who lost his life by a deed of which his Captain wrote "There has not been a grander act of heroism in the war." Briefly, an ignited bomb fell in a dug-out in which he and a number of men were congregated. He immediately picked it up and, pressing it to his body, made for the door; it exploded, but he managed by sacrificing himself to save his friends from all but minor injury. For this act he was posthumously awarded the Albert Medal of the First Class.

The unveiling ceremony commenced with explanatory remarks by the Director, Sir David Prain, followed by the reading of the Roll of Honour by the Chairman of the Committee of the Kew Guild, Mr. C. H. Curtis, and the formal handing over of the Memorial to the Director; then followed the reading of a portion of Ecclesiasticus, 44, by the Assistant Director, Captain A. W. Hill; the termination being the acceptance and unveiling of the Memorial, and an address by the Director.

About 150 near relatives of the dead and representatives of the various sections of the Kew Staff with numerous past Kew men were present at the ceremony, whilst the Ministry of Agriculture was represented by Mr. G. F. Middleton and H.M. Office of Works by Mr. G. D. Patterson.

Semiaquilegia ecalcarata.—Three different species have borne the name *Aquilegia ecalcarata*. Steudel, Nomencl. ed. 2, i. p. 115 (1840), recorded *A. ecalcarata*, Hortul. as a synonym of *A. vulgaris*, Linn.; the publication of this *A. ecalcarata* is invalid because it was cited in synonymy, and was based on an abnor-

mality (International Rules, Art. 37 and 51). Maximowicz gave the name *A. ecalcarata* in 1889 to a new spurless columbine from Kansu and Szechuan (Fl. Tangut. p. 20, t. 8, fig. 12). Two years later Miss Eastwood used it for a new spurless columbine from Colorado (Zoe, ii. p. 227). *A. ecalcarata*, Maxim., and *A. ecal carata*, Eastw., have recently been transferred to the genus *Semiaquilegia*, as *S. simulatrix* and *S. Eastwoodiae* (*Kew Bull.* 1920, p. 165). Maximowicz's species should, however, in accordance with the International Rules, if retained in *Semiaquilegia*, bear the name *S. ecalcarata*, Sprague et Hutchinson (comb. nov.). According to the late Mr. Reginald Farrer, it is abundant in alpine woods and backwoods in Kansu. Plants of *S. ecalcarata* have been raised from seed of Farrer no. 280 by Major F. C. Stern, Goring-by-Sea, Sussex.—T. A. S. and J. H.

The generic name Wikstroemia.—Three different genera, belonging to as many families, have been given the name *Wikstroemia*, in commemoration of the Swedish botanist Johan Emanuel Wikström, the author of a dissertation on *Daphne* (1817), a flora of Stockholm (1840) and other works. *Wikstroemia*, Schrad. (1821) is synonymous with *Haemocharis*, Salisb. (*Laplacea*, H.B.K.), one of the *Ternstroemiaceae*; *Wikstroemia*, Spreng. (1826) has been reduced to *Eupatorium*, Linn. (*Compositae*); and *Wikstroemia*, Endl. (1833), a genus of *Thymelaeaceae*, has been placed on the list of Nomina conservanda, provided for in Art. 20 of the International Rules of Nomenclature.

Some misunderstanding seems to have arisen as to the interpretation of Art. 20, the official (French) text of which reads as follows :—" Art. 20. Toutefois, pour éviter que la nomenclature des genres ne subisse par l'application stricte des règles de la nomenclature, et en particulier du principe de priorité à partir des dates données a l'art. 19, un bouleversement sans avantages, les règles prévoient une liste de noms qui doivent être conservés en tous cas. Ces noms sont de préférence ceux dont l'emploi est devenu général dans les cinquante ans qui ont suivi leur publication, ou qui ont été utilisés dans les monographies et dans de grands ouvrages floristiques jusqu'en 1890." This explicitly states that names included in the list are to be retained *in any event*, being exempted from the operation of the other Rules in so far as these would involve their rejection. Owing to the Nomina conservanda having been published in tabular form with Nomina rejicienda placed in a parallel column, the idea seems to have gained acceptance that they were only retained conditionally, being preferred merely to the Nomina rejicienda cited, but this view is precluded by the wording of Art. 20. *Wikstroemia* is a case in point. Blake has pointed out that the generic name *Haemocharis*, Salisb. was not effectively published, being unaccompanied by a description, and that the next name for this genus in order of priority is *Wikstroemia*, Schrad., which antedates *Laplacea*, H.B.K.* He concludes that, under the International

* Contrib. Gray Herb. liii. p. 36 (1918).

Rules, *Wikstroemia*, Schrad. should replace *Haemocharis*, and that consequently *Wikstroemia*, Endl., although it is a nomen conservandum, should be superseded by *Capura*. But it was with the express object of preventing such disadvantageous changes that Art. 20 was framed, and the wording of Art. 15 indicates that its operation is suspended whenever it conflicts with Art. 20. "Art. 15. Each natural group of plants can bear in science only one valid designation, namely the oldest, *provided that it is in conformity with* the rules of nomenclature and *the conditions laid down in articles* 19 *and* 20 *of section* 2." *Wikstroemia*, Schrad., would therefore be valid under Art. 15 but for the fact that *Wikstroemia*, Endl., is a nomen conservandum under Art. 20, which takes precedence. The generic names *Haemocharis*, Salisb., and *Wikstroemia*, Schrad., being thus unavailable, the ternstroemiaceous genus in question should be called *Laplacea*, H.B.K.

So much inconvenience has been caused in the past by the use of the same name for different genera, that it has seemed worth while to discuss the case of *Wikstroemia* in detail. It is desirable that no uncertainty should exist as to the interpretation of the International Rules.

It may be added that Schrader and Endlicher both used the spelling *Wickstroemia*, which was corrected by subsequent authors.

T. A. S.

"Bothalia."*—The Division of Botany and Plant Pathology of the Union of South Africa has issued the first part of a new work under this title, in memory of the first Union Premier and Minister of Agriculture, the late General Botha. It is edited by the energetic Chief of the division, is intended as a medium for the publication of papers and monographs based on the material in the National Herbarium, Pretoria, and will contain information regarding the vegetable resources of the country, its plant poisons and plant pests. The department is therefore now well supplied with means for the publication of results of the botanical investigation of the country, issuing in addition the "Flowering Plants of South Africa" (*Kew Bull.* 1920, 374), and its "Memoirs of the Botanical Survey" (*Kew Bull.* 1920, 139). We understand the new work will be published as occasion demands. The first part is devoted to the following papers:—"South African Ascomycetes in the National Herbarium," by Ethel M. Doidge; "The Genus *Bersama*" and "The Natal Species of *Sapindacae*," by E. P. Phillips; and "A Revision of the African Species of *Sesbania*," by E. P. Phillips and J. Hutchinson.—J. H.

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* "Bothalia," A Record of Contributions from the National Herbarium, Union of South Africa, Pretoria, edited by I. B. Pole Evans; vol. 1. pt. i, pp. 64, price 7*s.* 6*d.*—Pretoria, The Government Printing and Stationery Office, 1921.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION

No. 5] [1921

XIX.—EUCOMMIA ULMOIDES.

THE TU-CHUNG OF THE CHINESE.

JOHN PARKIN.

Our knowledge respecting *Eucommia ulmoides*, Oliv. has been largely gained from information supplied by Professor Augustine Henry, when resident at Ichang in China 1882–1890, and from the examination of fruiting specimens sent home by him during this period.* It is cultivated in the hilly regions of Central and Western China, and though reported to be wild, has not yet been seen so by Europeans.

The tree is grown by the Chinese for the sake of its bark, which they value highly as a drug, so much so that it commands a fancy price. To us, however, the bark is attractive on account of its containing silky, silvery threads. These can readily be made visible by breaking across a piece of bark and gently pulling apart the two fragments, which are then seen to be held together by numbers of delicate threads. These occur also in the leaves and fruits. They have been regarded as elastic, but this must be more apparent than real, as the material composing them is more akin to gutta-percha than caoutchouc (india-rubber). These substances† as a rule occur in the living plant in the form of minute globules suspended in a watery medium, the two together forming a "milk," which is held in elongated cells or vessels. Hence have arisen the botanical terms, "latex" and "laticiferous tube" for the emulsion and receptacle respectively. *Eucommia*, however, is exceptional in having its gutta-like substance existing in the dry, solid state in the living plant; so no milky juice exudes from any part when punctured. It shares this peculiarity along with the composite *Parthenium argentatum* (the source of Guayule Rubber) (*Kew Bull.* 1907, p. 285; 1908, p. 255; 1910, p. 211), and with *Chrysothamnus nauseosus* (Rabbit bush), a Composite plant of Colorado and

* Oliver, D. Hooker's Icon. Plant., xx., 1890, t. 1950. *Kew Bulletin*, 1901, p. 89; 1904, p. 4.

† An embracing term is much needed for these plant products (caoutchouc, gutta-percha, balata) of which the significant ingredient is a hydrocarbon of the turpene $(C_{10}H_{16})_x$ series. "Elastic gum" is not suitable as only one member of the group is markedly elastic.

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the neighbouring States of North America, which is said to be capable of supplying rubber of fair quality and in large quantities should it ever be needed to supplement that of *Hevea brasiliensis*.

Taxonomic Position. Systematically this tree occupies a somewhat isolated position. It is the sole member of the genus, *Eucommia*, which the late Prof. Oliver established for its reception.

From material supplied by Prof. Henry, Oliver* described the plant in 1890 and named it *Eucommia ulmoides*. In a further paper† he refers to the identity of his *Eucommia ulmoides* with Baillon's *Euptelea Davideana*, on the authority of Baillon‡ himself, but this identification was not justified, the two plants belonging to quite different genera§. He points out that though the nearest ally of *Eucommia* would appear to be *Euptelea*, it differs quite sufficiently to warrant the creation of a new genus for its reception. He further considers that there can be now no reasonable ground for hesitation in separating this genus, *Eucommia*, along with *Cercidiphyllum*, *Euptelea*, *Trochodendron* and *Tetracentron*, from the *Magnoliaceae*, and in placing them in a distinct family. He agrees to adopt Prantl's name, *Trochodendraceae*, for this new family, which differs chiefly from the true *Magnoliaceae* in having naked flowers (no perianth) and in being without oil glands. He lays stress on two features possessed by *Eucommia*, viz., solitary ovary with bifid stigma and caoutchouc-containing cells, which serve to distinguish it from *Euptelea*. As regards the first-mentioned feature, it may be asked: Are we to infer that the flower of *Eucommia* possesses a single carpel only, or that it has really a syncarpous dicarpellary gynoecium? If the latter inference be correct, then *Eucommia* would seem to be still less related to *Euptelea*; in fact its inclusion in the *Trochodendraceae* would be hardly warranted.

It is not the intention here to discuss fully the systematic position of this interesting tree, but it may be pointed out that Solereder‖ from his investigation of the female flower considered it syncarpous and dicarpellary, and was inclined consequently to place the plant in the *Hamamelidaceae*. Van Tieghem¶ likewise did not regard it as belonging to the *Trochodendraceae*, and to emphasize its isolated position, made a new family, the *Eucommiaceae*, for its reception. Engler agrees with this view, for in the latest edition of his *Syllabus der Pflanzenfamilien* (1919) the family, *Eucommiaceae*, occurs and is put in the cohort, Rosales, next to the *Hamamelidaceae*.

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* Oliver, D. l.c.

† Oliver, D. Hooker's Icon. Plant., xxiv., 1895, t. 2361.

‡ See letter from Baillon to Oliver in Herb. Kew.

§ See Hemsley in Hook. Icon. Pl. in syn. sub t. 2787.

‖ Solereder, H. Ber. Deutsch. Bot. Gesell., xvii., 1899, p. 387. In this paper the author disputes the identity of *Euptelea Davideana* Baill. with *Eucommia ulmoides*, Oliv., and considers it rather to be identical with *Euptelea pleiosperma*, Hook f. et Thoms. [This opinion was confirmed by Hemsley, l.c.—Ed.]

¶ Tieghem, van P., Journ. de Bot., xiv., 1900, p. 262; *see also* Mr. Hutchinson's paper on *Winteraceae*, p. 185 of this number.

Further investigation of the flowers of *Eucommia* and especially of the pistillate ones, would seen desirable in order if possible to gain new light on its real affinities.

Anatomical. Prof. Weiss* in 1892 worked out the development, distribution, and microscopical characters of the cells which elaborate these "elastic" threads in *Eucommia*. He also investigated to some extent the substance itself extracted from the bark.

Barthelat† and Dybowski et Fron‡ have since supplied extra details regarding the structure of these gutta-percha producing elements and their distribution in the plant.

This tree might repay further study from the anatomical side. The wood especially requires minute examination. Facts might possibly be forthcoming which would throw light on its relationship.

The Gutta-like Material. Weiss considered the substance composing the "elastic" threads of the bark to be of the nature of caoutchouc from its behaviour towards solvents. Consequently the specialised elements in the plant holding this material came to be termed caoutchouc-containing cells, and the tree itself to be spoken of as a rubber-yielding one for temperate climates.

Dybowski et Fron‡ from their economic enquiry came to the conclusion that the substance is much nearer akin to gutta-percha than caoutchouc. A French authority to whom they submitted a sample declared it to be gutta of good quality.

Sievers§ in a recent paper, apparently unaware of the French work, treats the substance as rubber and investigates its solubilities in various media.

In order to arrive at a rough idea of the amount of this material contained in the bark, Weiss ground up some of the latter and then extracted it with chloroform. He obtained a yield of 3 per cent. Oliver working independently with another sample of bark secured the same yield. Sievers by ether extraction obtained only a yield of 2 per cent. Dybowski et Fron estimated quantitatively the amount in the dried leaves and found that the percentage of gutta reached 2·25. The fruits were richer in the substance. Apparently the percentage in the bark was not ascertained by them.

In 1910 two bales of *Eucommia* bark secured in China came into the writer's possession. One bale contained 56 lbs. of bark and the other, though not weighed, presumably held half this quantity, judging from its size. During the rubber boom of that year considerable interest was taken in *Eucommia*. This, however, soon subsided and nothing of importance was published at that time regarding this tree, which was commonly

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* Weiss, F. E., Trans. Linn. Soc., London, 2nd ser. Bot. III, 1892, p. 243.

† Barthelat, Journ. de Bot. xiv., 1900, p. 55.

‡ Dybowski et Fron, Comptes Rendus, cxxix., 1899, p. 558.

§ Sievers, A. F., Journ. Amer. Chem. Soc., xxxix., 1917, p. 725.

spoken of as a hardy rubber-yielding one, in spite of the French work, already referred to, published ten years previously. The writer at this period took up the investigation of the bark. A preliminary examination convinced him that the substance had not the characteristics of rubber. On the other hand though resembling gutta-percha, it was found to be tougher and less plastic on heating.

Extraction by means of solvents is not, as a rule, to be recommended for rubber, gutta and such like bodies, as their desirable physical properties are apt to suffer in the process. Mechanical separation, when possible, is to be preferred. A firm of engineers interested in the rubber industry undertook in 1911 to experiment with the bark. The smaller bale was delivered over to it and attempts were made to separate the gutta-percha from the *Eucommia* bark; but the results were not satisfactory. The substance could not be obtained free from particles of bark. With the rapid fall in the price of raw rubber from the boom figures of 1910, interest fell off in new sources of rubber and allied substances, and business firms were no longer eager to experiment with unknown barks.

After the war Dr. P. Schidrowitz, to whom I am indebted for the information below, kindly undertook the investigation of the larger bale of bark and managed with some difficulty to separate in a clean state the gutta-like substance, which is tough and almost horny in consistency, and has the dark colour of most raw rubbers, but without their elasticity It is quite free from stickiness. By mechanical extraction the bark yields about two per cent.; whereas that of ordinary gutta trees gives twice or thrice this quantity.

The composition of this material is approximately as follows :—

Moisture	5·0	per cent.
Ash	2·5	,,
Resin	70·0	,,
"Gutta-percha"	22·5	,,

i.e., hydrocarbon $(C_{10}H_{16})_x$

It thus has a higher percentage of resin and a lower percentage of $(C_{10}H_{16})_x$ hydrocarbon than the raw gutta-percha of commerce, obtained from sapotaceous trees.

As regards its physical properties and economic possibilities Dr Schidrowitz wrote to me in March, 1920, as follows :—

"The material is not as plastic as high grade gutta-percha. It is very tough, but the gutta—after extracting the resins—is decidedly 'short' and does not compare favourably with 'hardened' (*i.e.*, extracted) gutta-percha. The electrical (insulation) properties are probably similar to certain grades of gutta, but so far as 'ageing' goes, the indications are that it does not compare favourably with good gutta. Of course, at a really low price (say 1/– to 1/6 per lb.) a use might be found for it, but I gather that anything of that kind is out of the question.

To get reliable tests as to strength, &c., I should need a good deal more of the material than I have."

Since then it has been found that mechanically extracted *Eucommia* gutta soon becomes brittle with age, which would render it well nigh useless for electrical purposes.

Medicinal Properties. *Eucommia* bark is held in high esteem as a medicine by the Chinese and is said to have invigorating and arthritic properties; but it is doubtful whether the bark really contains any principle of therapeutic value. A cursory examination of the dry bark from this point of view has resulted in the extraction of only a minute quantity (0·038 per cent.) of presumed alkaloid.

The Chinese believe in the doctrine of signatures, which asserts that a plant shows some resemblance to the organ of the body, for the disease of which it is useful; and the peculiar threads in this bark may have suggested its use as a drug to the Chinese.

The writer has still a little bark and some dried leaves at his disposal should anyone care to investigate *Eucommia* further from the medicinal aspect.

Growth and Behaviour of the Tree in the British Isles. France was the first European country to receive the living plant from China—apparently about 1890. Kew obtained in 1897 one *Eucommia* plant from M. Maurice de Vilmorin. This flowered for the first time in 1909 and proved to be a male tree. The other trees there have been propagated vegetatively from the original one. Some years ago information was supplied by Kew* respecting the hardihood, cultivation, and propagation by cuttings of *Eucommia*. Last winter Mr. W. J. Bean kindly furnished me with up-to-date details regarding the trees at Kew. He wrote as follows:—"At present we have four trees viz., the original one which never having been trained, has remained bushy and comparatively low; and three trees raised from cuttings taken from the original tree. The largest of these is now about 23 feet high, its trunk 22 inches in girth and clear of branches up to 7 or 8 feet. The other two have trunks 21 and 16 inches in girth respectively." He proceeds to say that pruning and training were found to be necessary to produce the tree-form in *Eucommia*, but thinks that if they were planted close enough they would form trees naturally.

The Royal Botanic Gardens, Edinburgh,† possess two trees. They were raised from Wilson's seed, No. 383, and were planted in their present position in 1911 in prepared ground on a lawn. They now measure‡ respectively in height 8 and 5 feet and in girth $5\frac{1}{2}$ and 4 inches. They are bushy and have not yet flowered.

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* Gardeners' Chronicle, xxxiii, 1903, p. 104. Kew Bulletin, 1904. p. 4.

† From information supplied by the Regius Keeper, dated 9.xii.20.

‡ The measurements recorded in this paper were taken in each case last winter (1920-21).

There are likewise two plants in the Royal Botanic Gardens, Glasnevin,* Dublin, which were raised from Wilson's seed and have been growing there about ten years. One is 15 feet high on a single stem and the other 8 feet and bushy. Both are thriving.

There are also two trees growing in the University Botanic Gardens,† Cambridge. One was obtained from Veitch and Son in 1905 and is 16 feet in height with a girth of 10 inches. The history of the other is uncertain. It is nearly 15 feet high with a girth of 12 inches. They are both growing in ground kept free from grass and weeds and are tree-like in habit.

Reports were also received last winter from several private British gardens and I wish here to express my thanks to the writers of the same.

At Sprowston Hall, near Norwich, Sir Eustace Gurney planted some Eucommias about ten years ago. They were obtained from M. de Vilmorin and were apparently rooted cuttings. All but two have been discarded. These are now only 12 feet high and 9 inches in girth, though well-sheltered and growing in good soil, kept free from grass.

Mr. Reginald Cory has two trees growing at Duffryn, near Cardiff. One obtained from Veitch and Sons, planted 1911 and once transplanted since, is now 15½ feet high and nearly 8 inches in girth. It is growing in cultivated ground and is tree-like in habit. The second tree was obtained as a sucker from the former 5–6 years ago and has grown well, being over 13 feet in height.

Mr. Gerald Loder possesses three trees, growing at Wakehurst Place, Ardingley, Sussex, also obtained from Veitch & Sons. One planted in 1910 in poor dry soil is 11 feet high (once had its top blown off) and 9 inches in girth. The other two planted in 1914, one in deep loam and the other in clay, are respectively 9½ and 9 feet high and 3 and 4½ inches in girth. The trees were planted carefully with the idea of keeping the ground clear of grass, but owing to the war this has been largely neglected.

Several trees, raised from Wilson's seed and planted probably between 1911–13, are growing in heavy clay at Aldenham House, Elstree, Herts. Measurements of three of these have been sent by the Hon. Vicary Gibbs, who states that these would approximate to those for the other trees. Their heights and girth respectively are 12 feet and 8 inches : 10½ and 5 : 9½ and 5.

All the reports received agree in one particular, namely, that *Eucommia* is perfectly hardy. At Duffryn the trees came through unharmed the winter of 1916–17, when 26 degrees Fahrenheit of frost were registered. At Aldenham they have withstood a temperature even below zero Fahrenheit.

Respecting all the above trees flowering has only been observed in the case of the Kew trees.

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* From information supplied by the Keeper through Prof. Henry, dated 3.xii.20.

† From information supplied by the Superintendent, dated 16 & 24.xii.20.

In the spring of 1910 the writer obtained from France a specimen of *Eucommia*. It was planted in a sunny portion in cultivated ground in a Cumberland garden, situated 200 feet above sea level and 8 miles inland. It has grown very well and has the following dimensions: height 17 feet, girth 13 inches. The severe frost we experienced in the north-west of England in November, 1919, killed a fair amount of the previous summer's growth of this tree. Male flowers were observed on it for the first time in the spring of 1919. It has bloomed in a similar fashion both last spring and this, without any signs of female flowers.

In April, 1911, I obtained two plants from Messrs. Barbier et Cie., Orleans One was planted in the open on grass in a frosty situation. It did not survive the following winter. The other one was put in cultivated garden soil and has once been transplanted. It is now 9½ feet high and 4 inches in girth.

In the autumn of the same year I obtained two dozen one-year seedlings which had been raised from Wilson's seed. They were wintered in a cold greenhouse and planted in the garden the following spring, where they grew well under cultivation. The attempt, however, to establish them in the open under forestry conditions has not met with success. Seventeen of them were pitted, mainly in the spring of 1916, along with other deciduous trees on a rough grassy bank. Ten of these have died and the remaining seven, though living, are not flourishing and may ultimately succumb. The new growth does not ripen sufficiently to withstand the frosts of winter and more especially the bleak winds of early spring. It would seem that in order to establish a plantation of *Eucommia*, in this part of England at any rate, cultivated ground with shelter would be necessary.

Eucommia, though a quick grower, has not a very satisfactory tree-habit of growth. It is inclined to put its energy into sub-ordinate sucker-like shoots, rather than into a single main leader. These shoots may attain as much as three feet in length during one season and are probably induced through the dying back of some of the last summer's growth. The tendency to a spreading, bushy, habit may be overcome to some extent by training and pruning. It remains to be seen whether *Eucommia* when closely planted would assume the tree-habit naturally and be drawn up with a straight stem.

Apparently plants raised from cuttings produce as good specimens as from seeds; though as to the ultimate height and girth reached by trees propagated in these two ways, no particulars are to hand. The plant cannot be raised from cuttings in the same easy manner as succeeds with willows, poplars, roses, etc. They require to be taken from the current year's growth in the middle of summer and subjected to gentle bottom heat. Probably layering might be found a more successful way of increasing this tree. Apparently it is one that would sucker freely and by this means shoots would be provided for layering.

The dearth of flowers calls for some comment. So far only the Kew authorities and myself have reported the production of flowers (male ones in both cases) by *Eucommia* in this country. As they are inconspicuous, they could be easily overlooked by anyone not familiar with them and not especially interested in the plant. They are produced just before the leaves in late April or early May, and the greenish-yellow appearance they give the tree might be mistaken for the bursting forth of the foliage leaves. This refers to the male (staminate) blooms only, but judging from analogy the female (pistillate) ones are likely to be even less noticeable. It is therefore quite possible that *Eucommia* may have flowered elsewhere in the British Isles, but the occurrence has escaped notice.

The tree is regarded as dioecious, and if this be correct then the offspring arising vegetatively from a single seedling will all be of one sex. This might account for the staminate nature of the British trees which have been observed to flower; but the behaviour of the Eucommias in the Arnold Arboretum suggests something more than chance in the non-production of female flowers. Professor Sargent informs me that the trees there have flowered for a number of years and are all staminate, and that he does not know of a pistillate plant in cultivation. Is the tree really dioecious? It may be monoecious and if so either climate or more likely age may influence the production of female flowers, and if so a fresh batch of seedlings may still disappoint in producing only male flowers. The plant evidently requires further study in China as regards its manner of flowering.

Economic Possibilities. The cultivation of *Eucommia* as a source of gutta-percha would appear to be a very doubtful economic undertaking, even if its gutta were found to be of commercial value. Anyone interested in trees and not minding expenditure which might never be remunerative, would by planting an acre, or even a less area, of this tree afford an instructive lesson as regards its sylvicultural possibilities. The experiment should preferably be tried in a mild part of the kingdom, such as the S.W. of England or of Ireland. There would then be little danger of the crippling effect of frost on the previous summer's growth, and at the same time conditions would be favourable for the assumption of the tree-rather than the bush-habit of growth

Given a use for the gutta-like substance and quick growth of the plant, there would still be drawbacks to be faced in its cultivation as an economic tree, viz.:—

1. The yield from the bark is low.

2. The gutta is not easily separated mechanically from the bark. This, however, might be overcome by engineering ingenuity.

3. As the gutta exists in the dry state in the living plant, it could not be extracted by tapping as in laticiferous trees. Hence a *Eucommia* tree could only give a yield of gutta once

by felling it and stripping it of its bark, (*a*) unless the substance could be extracted economically from its leaves or annual prunings, (*b*) or unless some means of paring off the bark without destroying the cambium could be devised, (c) or unless the tree were amenable to the coppice system. The last possibility is perhaps the most likely. In this case the peeled poles might form a subsidiary source of revenue.

4. High cost of land and wages.

In conclusion the writer would like to take this opportunity of expressing his thanks to Prof. Augustine Henry for much help in the compilation of these notes.

XX.—THE FAMILY WINTERACEAE.

J. Hutchinson.

The family *Winteraceae*, as here understood, has usually been regarded as a tribe of *Magnoliaceae*, and it stands as such in the classifications of Bentham and Hooker (Genera Plantarum, i. 17), and Engler and Prantl (Die Natürl. Pflanzenf. iii. ii. 18). In the following brief notes the present writer gives reasons for separating the group from the true* *Magnoliaceae*, represented by the genera *Michelia*, Linn., *Manglietia*, Bl., *Talauma*, Juss., *Aromadendron*, Blume, *Magnolia*, Linn., and *Liriodendron*, Linn. This segregation has become more imperative since the *Trochodendraceae* and *Himantandraceae* have been taken out of *Magnoliaceae*, and some degree of uniformity of treatment is now possible.

Robert Brown† was the first to point out that the genera *Illicium* and *Drimys* should be distinguished as a separate family from *Magnoliaceae*, and for them he proposed the name *Wintereae*. Lindley, for a time, and J. Miers took a similar view, as did also Endlicher, who expressed the opinion (Enchir. Bot. 428), that the group ought to rank as an independent family, although later (Genera Plantarum 836), he included them as a sub-family of *Magnoliaceae*. Even J. D. Hooker and T. Thomson (Fl. Ind. 72), say that "the *Wintereae* form a very questionable tribe of *Magnoliaceae*, and may with reason be separated from them." Hooker, however, as already indicated, included them in the *Magnoliaceae*.

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* Other genera referred to the *Magnoliaceae* are *Trochodendron*, Sieb. et Zucc., and *Euptelea*, Oliv., which constitute the distinct family *Trochodendraceae*, and *Cercidiphyllum*, Sieb. et Zucc. the *Cercidiphyllaceae* *Eucommia*, Oliv., and *Tetracentron*, Oliv., are better placed with the *Hamamelidaceae*, whilst *Himantandra*, F. Muell. (= *Galublimima*, Bailey), a remarkable genus incorrectly reduced by Mueller himself to *Eupomatia* (*Annonaceae*), has recently been made the type of a new family, *Himantandraceae* (*see* Diels "Über die Gattung *Himantandra*, ihre Verbreitung und ihre systematische Stellung," in Engl. Bot. Jahrb. lv. 126–131, fig. i (1917)).

† R. Br. apud DC. Syst. Veg. i. 548 (1818); De Candolle, however, treated them as a tribe, *Illiceae* of *Magnoliaceae*.

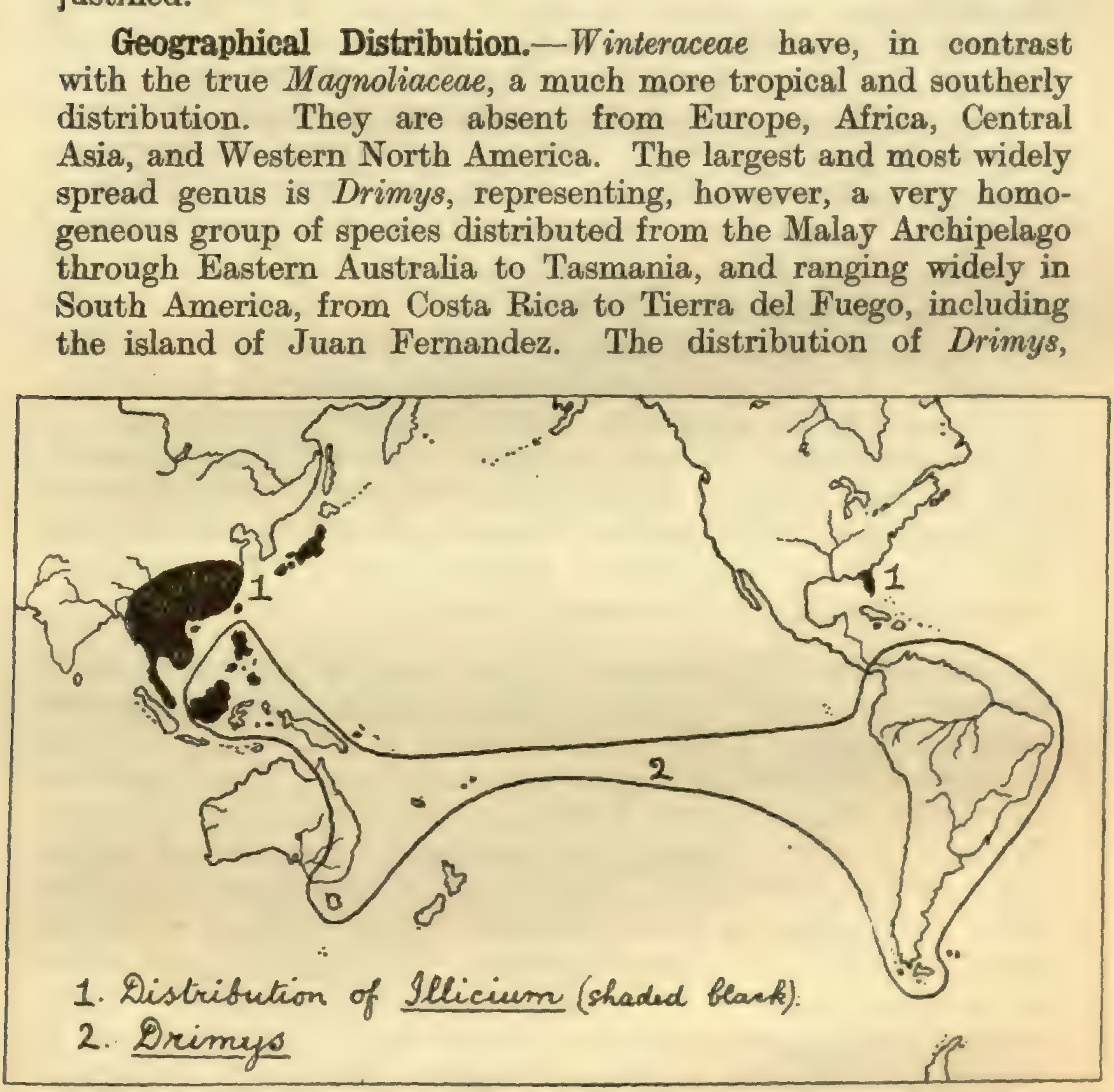
Although the *Winteraceae* are allied to the *Magnoliaceae* and may have had a similar origin, they are considerably more advanced from an evolutionary point of view, and they are very definitely distinguished from them by the following characters :— (1) absence of stipules; (2) secretory cells filled with resin or ethereal oil in the leaves, appearing as transparent dots; (3) very short and small floral axis; (4) relatively few stamens with small divergent anther-cells; (5) few carpels in a single whorl (or very rarely in 2 whorls), sometimes reduced to a single carpel; and there are corresponding differences in the fruits. I give here a key to the families more closely related to *Magnoliaceae*, and the group may take ordinal rank as *Magnoliales* :—

*Perianth present, conspicuous, never operculate; indumentum not lepidote :	
Flowers hermaphrodite; stamens free :	
Leaves stipulate, the stipules often enclosing and protecting the young growths; flowers large, solitary, terminal or rarely axillary; axis elongated and cone-like, especially in fruit; floral parts spirally arranged - - - -	**Magnoliaceae.**
Leaves exstipulate, pellucid punctate; flowers small or medium-sized, rarely solitary; axis short and never cone-like in fruit; carpels more or less in a single whorl -	**Winteraceae.**
Flowers unisexual; stamens partially or wholly connate into a globose mass; leaves exstipulate, often pellucid-punctate; trailing shrubs - -	**Schizandraceae.**
**Perianth present, operculate; indumentum lepidote; stamens petaloid -	**Himantandraceae.**
***Perianth absent or much reduced and bract-like; indumentum never lepidote; stamens not petaloid :	
Carpels 3; stipules large and interpetiolar, membranous; leaves minutely pellucid - punctate; flowers polygamo-monoecious; monotypic genus (*Lactoris*) in Juan Fernandez - -	**Lactoridaceae.**
Carpels more than three; stipules absent or small; Leaves not pellucid-punctate; East Asiatic trees and shrubs :	
Flowers hermaphrodite, clustered or racemose-paniculate; seeds not winged - - -	**Trochodendraceae.**

Flowers dioecious, solitary on short arrested branchlets; stipules adnate to the petiole, seeds winged - - - **Cercidiphyllaceae.**

Our knowledge of the family *Winteraceae* is still far from complete and much more collecting of the Australasian and South American species is desirable. With commendable perspicacity, however, considering the material available, the late Prof. Van Tieghem has separated two or three small genera from *Drimys*, which further study will probably show to be fully justified.

Geographical Distribution.—*Winteraceae* have, in contrast with the true *Magnoliaceae*, a much more tropical and southerly distribution. They are absent from Europe, Africa, Central Asia, and Western North America. The largest and most widely spread genus is *Drimys*, representing, however, a very homogeneous group of species distributed from the Malay Archipelago through Eastern Australia to Tasmania, and ranging widely in South America, from Costa Rica to Tierra del Fuego, including the island of Juan Fernandez. The distribution of *Drimys*,



therefore, seems to point to considerable antiquity, connecting as it does two widely separated areas in the Southern Hemisphere (*see* map); and in floral structure it has a slight tendency to unisexuality and reduction so fully carried out in the case of the *Schizandraceae*. *Illicium* again, has an interesting distribution closely resembling that of *Magnolia* and *Liriodendron*, but more subtropical. It is also a natural genus of closely allied species and must be of great age. It is confined to the Northern Hemisphere, from Assam to Japan and south to Borneo in the Old World, whilst in America it occurs only in Florida. *Illicium*

thus connects the floras of two widely separated areas in the Northern Hemisphere. The remainder of the genera are small and of very restricted range, *Wintera* in New Zealand, *Bubbia* in Lord Howe's Island and New Caledonia, and *Belliolum*, *Exospermum* and *Zygogynum* in New Caledonia.

Economic Products.—" Winter's Bark " from *Drimys Winteri*, Forst., South America; much used in Brazil as an astringent and stimulant. " Star Anise," ripe fruit of *Illicium verum* (*see Kew Bull.* 1888, 173 and figure), a native of South West China; condiment and spice and used for flavouring; fruit also contains a volatile oil distilled in large quantities by natives of Langson; this oil is used in cough mixtures (Greenish, Mat. Med. ed. 2, 106, 275 (1909). *Wintera axillaris* is aromatic and pungent and its wood serviceable for inlaying (Cheeseman, Fl. N. Zeal. 29).

Principal literature relating to the Winteraceae.—J. Miers, " On the Winteraceae," Ann. & Mag. Nat. Hist. ser. 3, ii. 33–48, 109–115 (1858); and Contrib. to Bot. i. 123–145, pl. 25–27 (1851–61). Lindley, Nat. Syst. Bot. 26 (1830); ed. 2, 17 (1836); Veg. Kingd. 417 (1846) (under *Magnol.*). Endlicher, Gen. Pl. 836 (1836) (under *Magnol.*). Eichler in Mart. Fl. Bras. xiii. i. 129–139, tt. 30–32 (1841). Benth. & Hook. f. Gen. Pl. i. 17 (under *Magnol.*). J. Tambon, " des Illicium en général de la Badiane et de son Huille essentielle en Particulier " pp. 77, pl. 1–4 (Montpellier 1886). Prantl in Engl. & Prantl, Nat. Pflanzenf. iii. ii. 18, fig. 17 (1891); Nachtr. ii. 108–9 (1906) (under *Magnol.*). P. Parmentier, " Histoire des Magnoliacées (Tribe Illiciees) " in Bull. Sci. Fr. et Belg. xxvii. 159–337 (1895); Van Tieghem, Journ. de Bot. xiv. 275 et seq. (1906).

Description of Winteraceae. Trees or shrubs with exstipulate alternate or rarely subverticillate aromatic pellucid-punctate evergreen leaves. Flowers rather small, in axillary or terminal fascicles or umbellate cymes, of various colours. Floral axis very short, with the parts of the flower arranged more or less in whorls. Perianth double. Sepals 2–6, free and imbricate, or united and rupturing valvately. Petals in 2—several series, imbricate, often conspicuous in bud. Stamens several, in one or several series, hypogynous; anthers introrse. Carpels in a single whorl or rarely subbiseriate, 1—many, free or rarely united, 1—many-ovuled; stigma sessile or on a distinct style. Fruit capsular or baccate. Seeds with copious endosperm and minute embryo.

Anatomical features.—Mainly those of true *Magnoliaceae*. The leaves are markedly papillous and glaucous below in nearly all the species. They contain secretory cells which are filled with resin or ethereal oil, and these are visible especially in young leaves, appearing as translucent dots. *Drimys* is remarkable in having no vessels in the xylem, a feature common to the *Gymnosperms*, and the wood resembles very much that of the *Araucarieae* especially. It consists entirely of wood prosenchyma, the elements of which have bordered pits and are square

in cross section. The perforations of the vessels in the family (when present) are scalariform with very numerous bars, much more numerous than in the true *Magnoliaceae* (*see* Solereder, System. Anat. Dicot. engl. ed. i. 31 (1908).

Characters occurring in few genera and species.—Leaves subverticillate (in threes) in *Drimys rosea*, Ridl. (New Guinea). Inflorescence a single terminal sessile flower in *Zygogynum Vieillardii*, Baill. (New Caledonia); of three simple terminal pedicels in *Exospermum* and *Zygogynum* spp.; of several pedicels in *Drimys* spp.; a terminal cluster of cymes in *Bubbia* and *Drimys* spp.; pedicels narrowly winged in *Drimys parviflora*, Ridl. Calyx completely closed in bud in *Drimys*; imbricate in *Illicium*. Carpels united in tribe *Exospermeae*; capsular, beaked and stellate in *Illicium*; reduced to one in *Drimys dipetala*, F. Muell., and *Zygogynum pomiferum*, Baill.

Genera 7; Species 62.

DISTRIBUTION.—Eastern India to Japan and New Zealand, Florida, Central and South America.

KEY TO GENERA.

Sepals imbricate; carpels free from one another, spreading, compressed laterally and stellately arranged in fruit — Tribe	I. ILLICEAE.
Only genus - - - -	1. **Illicium.**
Sepals valvate; carpels more or less erect:	
*Carpels free, especially in fruit - Tribe	II. DRIMYDEAE.
Calyx enclosing the petals in bud and at length rupturing - -	2. **Drimys.**
Calyx exposing the petals in bud, small and more or less cup-like:	
Flowers solitary and axillary; petals 5–6 - - - -	3. **Wintera.**
Flowers in a terminal cluster of many-flowered cymes; petals 10–14:	
Inner series of petals 4–6; stamens with two widely divergent anther-cells - - -	4. **Bubbia.**
Inner petals 10; stamens with linear and parallel contiguous anther cells - - -	5. **Belliolum.**
**Carpels more or less united, especially in fruit - - - Tribe	III. EXOSPERMEAE.
Carpels 7–8, with conspicuous grooves between them in fruit, partially united - -	6. **Exospermum.**
Carpels 1–4, closely united, each separated by a very thin wall	7. **Zygogynum.**

1. **Illicium,** *Linn.* Syst. ed. x. 1050 (1759).—About 20 species, in Indo-Malaya, China, Japan, Florida (*see* map). Type species: *Illicium anisatum*, Linn., Japan and China.—Benth. & Hook.

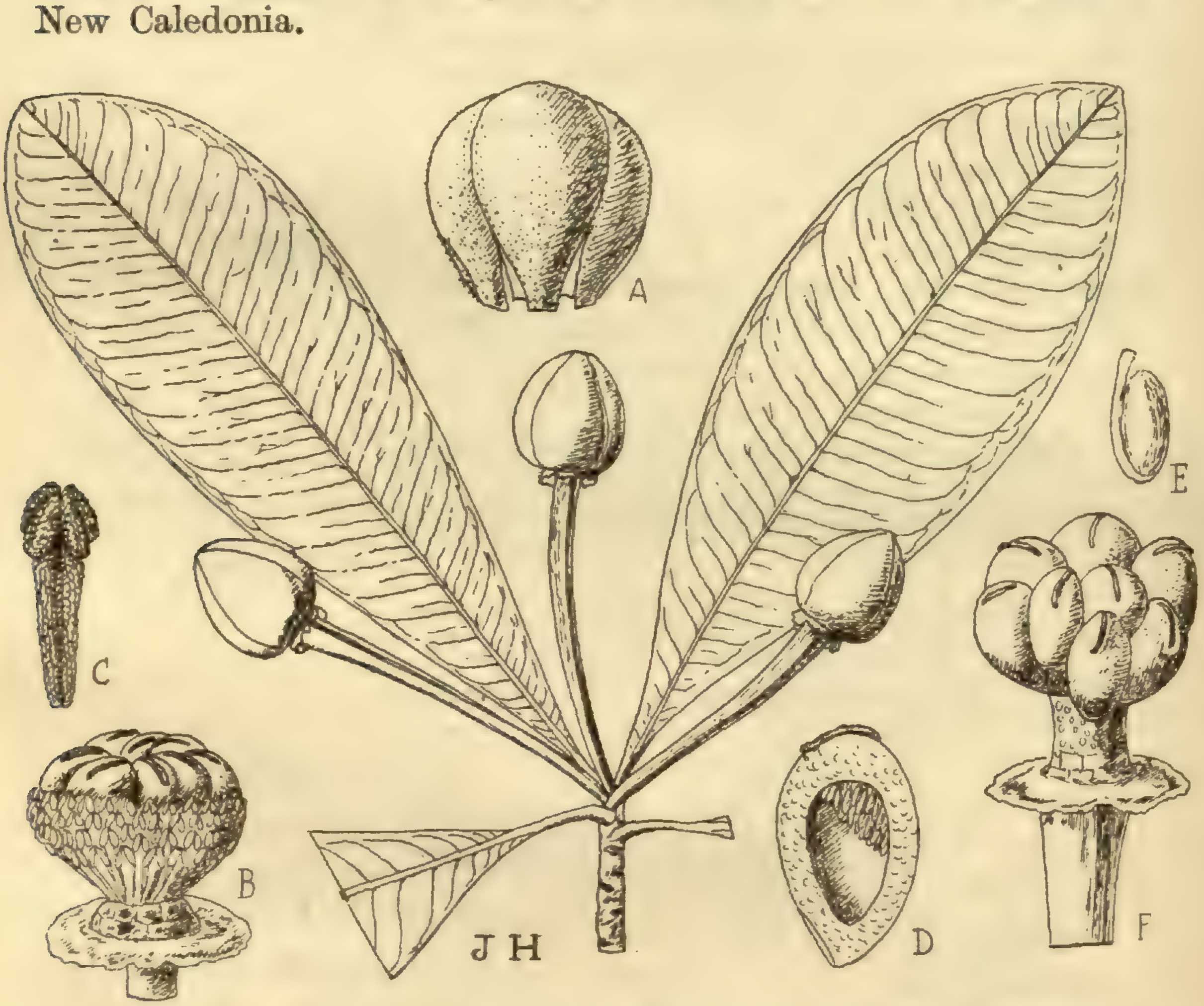
f. Gen. Pl. i. 18. Prantl in Engl. & Prantl, Pflanzenf. iii. ii. 18. J. Tambon, l.c. (*see* p. 188).

2. **Drimys,** *Forst.* Char. Gen. 83, t. 42 (1776).—About 20 species, Malay Archipelago to East Australia and New Caledonia, Central and South America (*see* map). Type Species: *Drimys Winteri*, Forst., South America—Benth. & Hook. f. Gen. Pl. i. 18. Prantl in Engl. & Prantl, Fflanzenf. iii. ii. 19.—For critical account of the South American species see Miers in Ann. & Mag. Nat. Hist. ser. 3, ii. 42 (1858). For discoursive account of *Drimys* see Van Tieghem in Journ. de Bot. xiv. 280 (1900), a summary of which appears in Engl. & Prantl, Pflanzenf. Nachtr. ii. 108 (1906).

3. **Wintera,** *Forst.* Fl. Ins. Austr. Prodr. 42 (1786), non Murr.—3 species, New Zealand. Type species: *Wintera axillaris*, Forst.—Cheeseman, Fl. N. Zeal. 29 (as *Drimys*).

4. **Bubbia,** *Van Tiegh.* in Journ. de Bot. xiv. 278, 293 (1900). —7 species, 5 in New Caledonia, 2 in Lord Howe's Island.

5. **Belliolum,** *Van Tiegh.* l.c. 278, 330 (1900).—4 species in New Caledonia.



Exospermum stipitatum, Van Tiegh. A. outer and closely connivent petals. B. flower with petals removed. C. stamen. D. section of carpel. E. ovule. F. young fruit.

6. **Exospermum,** *Van Tiegh.* l.c. 279, 333 (1900).—2 species, New Caledonia.—Type species: *Exospermum stipitatum* (*see* text figure).

7. **Zygogynum,** *Baill.* Adansonia, vii. 298 (1867).—6 species, New Caledonia. Type species : *Zygogynum Vieillardi.*

XXI.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS. (II.)

Joseph Burtt-Davy.

21. **Elephantorrhiza obliqua,** *Burtt-Davy* [Leguminosae-Adenanthereae]; *E. Burchellii*, Benth., affinis, sed foliolis paucioribus latioribus obliquis, calycis lobis longioribus et caulibus puberulis differt.

Suffrutex perennis. *Caules* annui, e collo crescentes, circiter 6 dm. alti, striati, puberuli. *Folia* 4–5-juga; pinnae 13–16-jugae; rhachis rhachillaeque sparse pilosae; foliola 1·2–1·3 cm. longa, 3–4 mm. lata, valde obliqua, mucronata, glabra; costa prominens. *Racemi* subsessiles, 6–7·5 cm. longi, ex axillis foliorum inferiorum crescentes; pedicelli 1 mm. longi. *Calycis* lobi acuminati. *Legumen* non vidi.

South Africa. Transvaal : Carolina Dist., High-veld between Carolina and Oshoek, at an out-span about 1 mile from Robinson's, in open grass-veld about 1650 m., Jan. 10, 1905, *Burtt-Davy* 2976 *in herb. Mus. Brit.*

22. **Plectronia ovata,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; *P. glaucae*, K. Schum., et *P. spinosae*, Klotzsch, affinis.

Frutex spinosus; spinae tenues. *Petioli* tenues, 4–6 mm. longi. *Laminae* late ovatae, obtusae vel aliquando attenuatae, ad basim truncatae, 2·5 cm. longae, fere 2·5 cm. latae, glabrae, subter glaucescentes. *Pedunculi* tenues, glabri, 1·2–1·9 cm. longi, 10–20-flori; pedicelli tenues, cymoso-fasciculati, glabri, 6–7 mm. longi. *Corollae* fauces barbatae; lobi reflexi, 2·5 mm. longi, glabri, intus pallentes. *Filamenta* inclusa; antherae exsertae. *Stylus* 2·5 mm. exsertus, 2-lamellatus. *Ovarium* glabrum.

South Africa. Transvaal : near Barberton, Dec. 29, 1903 (in flower), *T. C. Legge in herb. Transv. Dep. Agric. No.* 1728 *and* 1729. The type is No. 1729 *in herb. Bolus.*

23. **Plectronia foliosa,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; species distincta, ramulis robustis foliosis, foliis magnis.

Arbor parva, ramulis robustis puberulis aliquanto quadrangularibus. *Stipulae* triangulo-acuminatae, circiter 1·2 cm. longae. *Petioli* 1·2–1·8 cm. longi, puberuli. *Laminae* 9–11·5 cm. longae, 3–5 cm. latae, supra puberulae, subter tomentosae, apice acutae vel apiculatae, basi in petiolum gradatim attenuatae; nervi subter prominentes, puberuli; nervi laterales pinnatim dispositi, angulo inter nervos et costam acuto. *Pedunculi* circiter 1·3 cm. longi, pubescentes, cymoso-ramosi, ad apicem ramulorum aggregati, circiter 5 cm. longi; pedicelli breves, circiter 6 mm. longi. *Flores* non vidi.

South Africa. Transvaal: Waterberg Dist., Warm Baths, about 1080 m., January 1906, *Burtt-Davy* 5161 (*in herb. Bolus*).

24. **Plectronia Junodii,** *Burtt-Davy* [Rubiaceae-Vanguerieae]; *Canthio livido*, Hiern, affinis, sed frutex major pubescens, foliis exsiccando minus nigrescentibus, basi abrupte rotundatis vel truncatis, cymis minoribus congestis, corollae lobis duplc longioribus differt.

Frutex 1·5–3 m. altus; ramuli patentes, circiter 15 cm. longi; ramuli, petioli, pedunculi, pedicelli, folia juvenilia et costae foliorum seniorum pubescentes. *Foliorum* petioli 6 mm. longi; laminae 4·5-6·5 cm. longae, 3·2–3·8 cm. latae, ovales, apiculatae vel acutae, basi abrupte rotundatae vel truncatae. *Pedunculi* aliquanto pauciflori; pedicelli ad 4 mm. longi, tenues. *Flores* 3 mm. longi. *Corollae* tubus glaber, fauce tomentosa; lobi 2 mm. longi.

South Africa. Transvaal: Pietersburg Dist., Shilouvane, "ravin du Masetane," *Junod* 720 *in herb. Kew* (type).

Trop. Africa. Nyasaland: Zomba and vicinity 840–1140 m., *A. Whyte*. Gazaland (Port E. Africa), Madanda Forest, *Swynnerton* 2154.

25. **Pterocelastrus Galpinii,** *Loesen.* var. **parvifolia** *Burtt-Davy* [Celastraceae—Celastreae]; frutex, a forma typica ramis angulosis, foliis subsessilibus 2–3 cm. longis 6–9 mm. latis anguste oblongis coriaceis glabris, costis infra prominentibus, pedunculis paucifloris 5 mm. longis vel minus, fructibus subsessilibus 5–6 mm. longis prope apicem tuberculatis differt.

South Africa. Transvaal: Pietersburg Dist., Houtbosch, *Rehmann* 6055 *in herb. Kew.*

26. **Rhynchosia confusa,** *Burtt-Davy* [Leguminosae-Phaseoleae]; *R. nervosae*, Benth., et *R. hirsutae*, E. et Z., affinis, sed pedunculis paucifloris brevioribus, foliolis minoribus obtusioribusque pubescentibus non fulvidis distincta.

Herba perennis, prostrata, caulibus puberulis. *Folia* canopubescentia, reticulata; costae infra prominentes. *Stipulae* subulatae. *Petioli* 0·5–1 cm. longi. *Foliola terminalia* obtusa, retusa, apiculata vel subacuta, 1·3–2 cm. longa, 1·2–1·6 cm. lata, petiolulis 5 mm. longis. *Pedunculi* tenues, foliolis breviores vel parce excedentes, floribus paucis (2–4); pedicelli tenues, breves (1–2 mm. longi). *Flores* circiter 8 mm. longi. *Calycis* lobi lanceolati, acuminati, pubescentes. *Corolla* glabra, calycis tubo circiter 3 mm. longior. *Legumen* puberulum, circiter 2 cm. longum et 7 mm. latum.—*R. nervosa* var. *pauciflora*, Harv. in Fl. Cap. ii. p. 253 (1861–62).

South Africa. Transvaal: Pretoria Dist., Magalies River, *Zeyher* 510 *in herb. Cantab.* (type); Aapjes Riv. and Vaal Riv. (the latter in the Potchefstroom District) *Zeyher*, 508, 511. Orange Free State: Kroonstad Dist., Rhenoster Kop, *Zeyher*. British Bechuanaland: Kuruman Dist., near the Kuruman and

Moshowing Rivers, *Burchell* 2298, 2457 and 2548 B; Vryburg Div., near Geluk, *Burtt-Davy* 11,121.

27. **Rhynchosia Burkei,** *Burtt-Davy et Baker fil.* [Leguminosae-Phaseoleae]; species petiolis longis, foliolis terminalibus obovatis obtusis retusis vel apiculatis, subter sparse et pallide glandulosis, et racemis quam foliolis brevioribus et pauciflоris distinguitur.

Caules prostrati, robusti, striati, pubescentes. *Stipulae* lanceolatae, acuminatae, striatae. *Petioli* 2·25–3 cm. longi. *Foliola terminalia* obovata, obtusa retusa vel apiculata, sparse ciliata, 2–3 cm. longa, circa 2·5 cm. lata, petiolulis 1 cm. longis; foliola lateralia obliqua; pagina superior glabra et sparse reticulata; pagina inferior sparse glandulosa, costa et nervis secundariis prominentibus et sparse pilosis, foliolorum juvenilium nervis tomentosis. *Racemi* axillares, foliolis breviores, pauciflori; pedicelli 1 mm. longi. *Calycis* lobi lanceolati, acuminati, pubescentes. *Corollam* non vidi.—*R. adenodes* var. ? *robusta,* Harv. in Fl. Cap. ii. p. 254 (1861–2).

South Africa. Orange Free State: Thabanchu, *Burke in herb. Kew* (type); *Zeyher* 509 *in herb Cantab.*

28. **Rhynchosia Harmsiana,** *Schlechter* var. **Burchellii,** *Burtt-Davy* [Leguminosae-Phaseoleae]; *R. gibbae,* E. Mey., affinis, sed caulibus tenuioribus, foliolis minoribus obtusis, bracteis minoribus, floribus multo minoribus, carinis concoloribus differt.

Herba tenuis, volubilis, pubescens. *Caules* tenues, pilis brevibus retrorsis pubescentes. *Petioli* 1·3–1·8 cm. longi; petiolulus folioli terminalis 2–4 mm. longus. *Foliola* acuta vel obtusa, supra et nervis infra minute strigosa, subter glandulis pallide fulvis sparse glandulosa; foliola lateralia obliqua; terminalia aliquanto rhomboidea, 1·3–2 cm. longa, 0·9–1·5 cm. lata. *Pedunculi* foliis longiores, 5–7·5 cm. longi, floribus paucis (5–7) distantibus; pedicelli circiter 2 mm. longi. *Calyx* glandulis punctatus; lobi breves, lati, acuti; infimi multo longiores et subulato-acuminati. *Corolla* 5 mm. ultra calycem exserta, fulva; vexillum glabrum, purpureo-brunneo-striatum; carina concolor. *Legumen* strigosum, sparse hirsutum; rostrum tenue, ad 2 mm. longum.

South Africa. Cape Province: near Komgha, 600 m., a small climber among shrubs, *Flanagan* 796 *in herb. Kew* (type): Van Stadensberg, *Burchell* 4746; Kentani, *Pegler* 2032; Humansdorp Div., Kromme River, *Burchell* 4860. East Griqualand: near Clydesdale, 750 m., climbing on shrubs, *Tyson* 2073. Natal: Umzumbi, *Medley Wood* 3143.

29. **Rhynchosia Pentheri,** *Schlechter,* var. **Hutchinsoniana,** *Burtt-Davy et Baker fil.* [Leguminosae—Phaseoleae]; *R. Pentheri,* Schlechter, affinis, sed foliis sessilibus vel subsessilibus, calycis lobis hirsutis plus minusve glandulosis differt.

Herba robusta, prostrata; caules striati, pilis patentibus hirsuti. *Folia* sessilia vel subsessilia, supra sparse strigosa,

infra in nervis sparse setulosa; nervi infra prominentes; foliolum terminale, brevissime petiolulatum, rotundatum, obtusum, 3–3·4 cm. longum, 3–3·3 cm. latum; foliola lateralia obliqua. *Racemi* ad 15 cm. longi, floribus plus minusve laxe racemosis; pedunculi 7–10 cm. longi, glanduloso-hirsuti; pedicelli 2–5 mm. longi. *Flores* circiter 1 cm. longi; calyx hirsutus, plus minusve glandulosus; lobi longe acuminati, corolla immatura longiores. *Corolla*: carinae apex purpureus; vexillum flavum, purpureo-striatum. *Legumen* non vidi.

South Africa. Natal: Karkloof, 900–1200 m., *J. Wylie in herb. Wood* 7212; Edendale, 900–1200 m., amongst grass on hills, *Wood* 4601; Van Reenen, 1500–1800 m., on hillsides, *Wood* 6674; near Northdene, 150 m., Wood 3180. East Griqualand: in grassy places near Clydesdale, 750 m., *Tyson* 2068.

30. **Conyza pinnatifida,** *Less.* Syn. Comp. p. 204 (1832).

South Africa. Transvaal: Groenkloof, Pretoria, Sept. 1920, *van Dam in Transv. Mus. Herb.* 12,003 (vide Mrs. Pott *in Ann. Transv. Mus.* vi. pt. 4, pp. 119–135); Waterberg Dist., on the farm "Twenty-four Rivers," Nov. 1919, a garden weed, *Burtt-Davy*, 18,209.

This is a Cape Province Composite of recent introduction into the Transvaal, Mrs. Pott's being the first record of its occurrence. Twenty-four Rivers is an isolated cattle ranch some 40 miles or more N.N.W. of the railway at Nylstroom, away from any main road, and about 80 miles north of Pretoria. Not a single specimen of the plant was seen on the 40 miles of road from Nylstroom, which runs through a thinly populated area with but little cultivation. The early appearance of this weed so far from Mrs. Pott's locality suggests a tendency to spread rapidly. The seeds may have been carried with plants from some nursery, or by cattle—there has been a large influx of cattle into the Waterberg district in the last two or three years. The achenes are readily wind-distributed, and the plant may become as troublesome a weed as *Erigeron linifolius* now is.

31. **Salsola foetida,** *Del.*; Fl. Cap. v. Sect. 1, p. 452.

South Africa. Transvaal: Bloemhof Dist., farm "Kaffraria" near Christiana, Mch. 1912, gregarious, forming a colony in "brak" (i.e. saline) soil, *Burtt-Davy* 12,800 *in herb. Bolus.*

One of the plants called "Ganna-bosch." An interesting extension of known range. This appears to be a rare plant in South Africa, or rarely collected, only one specimen being cited in the *Flora Capensis* (*Bolus* 596, from Graaf Reinet); my specimens were but a few inches high, instead of "1–4 ft." as described for the species, and lacked the foetid, fishy smell mentioned by Dr. Bolus on his label. I am indebted to Mrs. Frank Bolus for the determination. Outside S. Africa it is found in Tropical and North Africa, Western Asia, and India.

32. **Chenopodium glaucum,** *Linn.* Sp. Pl. ed. 1, p. 320 (1753)

South Africa. Transvaal: Heidelberg Dist., Burttholm near Vereeniging, about 1450 m., plentiful on dried mud of a dam, *Burtt-Davy* 18,155 *in herb. Bolus*; Standerton Dist., Paardekop, about 1690 m., in wet places, *Schlechter* 3448 *in herb. Kew.*

Common in many parts of Europe and temperate Asia and along the coast of Australia; sporadic in other parts of the globe. My specimens agree well with some collected at Hudson's Bay by Burke and in the Chonos Archipelago by Darwin, both in herb. Kew. In Colorado, U.S.A., *Chenopodium glaucum* is found in "damp alkaline soil" (*Eastwood*), and in Saskatchewan Bourgeau collected it "dans les marais salés de la prairie," In Tasmania it is said to be "common on the sea-coast near high-water mark." The dam at Burttholm, where my specimens were found, is but very slightly "brak" (*i.e.*, saline) and the other plants with which they were there associated are not halophytes; the Paardekop habitat is not likely to be saline owing to heavier rainfall and better drainage. Though the plant is halophytic in the sense that it tolerates saline soils, it does not appear to be a true halophyte, but rather a hydrophyte which thrives in somewhat saline spots, perhaps not because of their salinity but because they are moist and unshaded and furnish ample space for small species of prostrate habit.

33. **Chenopodium carinatum,** *R. Br.* Prodr. p. 407 (1810).

South Africa. Transvaal: Heidelberg Dist., Burttholm, 9 miles from Vereeniging, naturalized on a gravel drive, Mch. 1917, *Burtt-Davy*, 17,224 *in herb. Bolus.*

An annual prostrate herb, native of Australia, New Zealand and New Caledonia. Not previously recorded for S. Africa Probably introduced with Australian garden seeds.

34. **Potamogeton nodosus,** *Poir.* in Lam. Encycl. Suppl. iv. p. 535 (1861). *P. fluitans*, Auct. non Roth.

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, October 1915 and December 1919, in deep, still pools (associated with *P. crispus*, *P. badius* and an *Aponogeton*) *Burtt-Davy* 15,389, 18,175 and 18,176. Mr. Bennett has kindly studied my specimens and says of this species: "Distributed under many names. Hagström (*Anat. Stud. Pot.* 1916, pp. 183–199) gives the best account of the plant yet given, although I do not agree with all his references to other names. The plant is distributed over Europe, N. America, Africa, Asia (rare) and perhaps the Marianne Islands. It has constantly been mixed up with *P. fluitans* Roth. (a hybrid), and Hagström was the first to really separate the various mixings."

35. **Potamogeton crispus,** *Linn.* Sp. Pl. ed. 1, p. 126 (1753).

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, Dec. 1919, *Burtt-Davy* 18,178. Mr. Bennett says: "In habit this is much like the Australian being smaller, with narrower leaves, etc., than the European

specimens. The only specimens I have before seen from the Transvaal are in the Delessert Herbarium at Geneva, viz., *Wilms* No. 1658, and this is named by Graebner in Engler's Pflanzenreich, Heft. 31, 1907, p. 100 as var. *najadoides*, giving as characters: 'Planta gracilis. Caulis tenuis. Folia remota, angusta, ca. 3 cm. longa, valde crispa. Spica pauciflora, dein recurvata.' Your plant has not 'folia remota' nor 'spica recurvata'."

36. **Potamogeton badius,** *Hagström* Crit. Res. Pot. p. 104 in K. Svensk. Vet.-Akad. Handl. lv. No. 5, (1916). *P. pusillus* Auct. non Linn. Founded on Drége 4458 from "Cap. bon. Spei."

South Africa. Transvaal: Heidelberg Dist., Klip River at Kookfontein near Vereeniging, Dec. 1919, *Burtt-Davy*, 18,177; Lydenburg, *Wilms* 1656 and 1657, Dec. 1894, *in herb. Delessert and herb. Bennett.* Natal: *Medley Wood* 3055, sub nom. *P. obtusifolius in herb. Kew* and *herb. Bennett.* Cape Province: Buffalo River, King Williams Town, Apl. 7, 1885, *J. Leighton in herb. Kew* and *herb Bennett;* "In (cap) bon spei" *Mundt and Maire* (sub nom. *P. pusillus*) *in herb. Berlin;* teste A. Bennett in litt.

37. **Peponia caledonica,** *Cogn.* in DC. Monogr. Phan. iii. p. 410 (1881). *Luffa caledonica* Sond. in Fl. Cap. ii. p. 490 (1861–62).

South Africa. Transvaal: Witwatersrand, Houghton Ridge, Johannesburg, about 1710 m., May 31, 1915 (in fruit), *Burtt-Davy* 15,262 *in herb. Bolus.* Orange Free State: Wolve Kop, near the Caledon River (the type locality), *Burke* 305 and *Zeyher* 589 *in herb. Kew;* near Bethlehem, *Bolus* 8162; Winburg Dist., Doorn Kop, *Burke.* Basutoland: *Cooper.* Cape Province: near Cradock, *Cooper;* Graaf Reinet Div., near Wagenpad's Berg (on the southern side), *Burchell* 2837.

The Transvaal locality is an interesting northerly extension of known range. The leaves vary much in depth of sinus, but the Johannesburg plant compares well with the type.

38. **Scandix Pecten-Veneris,** *Linn.* Sp. Pl. ed. 1, p. 256 (1753).

South Africa. Transvaal: Government Experiment Farm, Potchefstroom, Oct. 1909, *Burtt-Davy* 5590 in *Transv. Dep. Agric. herb.* A cornfield weed, adventive from Europe. It is distributed through Europe, N. Africa, W. Asia, to N.W. India, and is also naturalized in N. America.

39. **Tournefortia tuberculosa,** *Cham.* in Linnaea, iv. p. 467 (1829). *Heliotropium tuberculosum,* Guerke in Engl. & Prantl., Nat. Pflanzenfam. iv. 3a, p. 94 (1893), non Boiss.

South Africa. Transvaal: Bloemhof Dist., farm Kaffraria near Christiana, Mch. 1912, *Burtt-Davy* 12,820 *in herb. Bolus.* "Flowers creamy-white, small." This is an interesting addition to our flora as it is distinctly a Karroo ("Central Region") species, found in the Prince Albert, Colesberg, Victoria West and

Calvinia Divisions, extending north to Great Namaqualand, tropical S.W. Africa and Griqualand West.

In *Index Kewensis*, Suppl. 1, p. 200 this species is referred to as "*Heliotropium tuberculatum*, Guerke = *Messerschmiedtia tuberculata* Cham." The entry should read "*H. tuberculosum*, Guerke = *Tournefortia tuberculosa*, Cham."

40. **Polygonum plebeium,** *R. Br.* Prodr. p. 420 (1810). *P. herniarioides*, Del. Resembling forms of *P. aviculare*, Linn. in habit, and easily confused with it in the flowering state; equally polymorphic. Stem trailing; internodes short; minutely scaberulous (sometimes smooth ?); leaves linear-oblong, 4–10 mm. long, minutely scurfy or glandular, especially below; midrib prominent, lateral nerves obscure; stipules lacerate; nerve mostly 1 (rarely 2 or more or 0); fruit rhomboid, blackish-brown, smooth, shining.

Tropical Africa. Transvaal; north through S. Rhodesia (Gwelo), Abyssinia, Egypt and Tropical Asia.

Hooker (*Fl. Brit. Ind.* v. p. 28; 1886) includes "S. Africa" in the range of distribution of this species, probably on the strength of Drége's specimen from the Victoria West Div. ("Nieuwe Veld") which Drége named *P. herniarioides*. Drége's plant has been referred to *P. aviculare*, Linn., but though the specimen is immature I am inclined to the opinion that Drége was right in his determination; the leaves have the peculiar scurfy cuticle of *P. plebeium*; though the nerves of the ochreae are more numerous than in typical *plebeium*, the variety *polyneura*, Hook. f. has equally numerous nerves, and further agrees in the long, narrow and revolute leaves.

Var. **micranthemum,** *Hook. f.* Fl. Brit. Ind. v. p. 29 (1886). Small, slender, lax and somewhat flaccid; leaves 6–8 mm. long, linear or linear-oblong, narrowed to the base, obtuse to acute, flat; flowers small; pedicel 1–2 mm. long, 2 mm. broad; sepals narrow, green with white margins; fruit about 1 mm. long or less, blackish-brown.

South Africa. Transvaal: Waterberg Dist., Tamboties River, 960 m., common on wettish alluvial ground, overflowed during rains, Dec. 1919, *Burtt-Davy* 18,309. Agrees well with Wallich's 1691/5 (from the banks of the Irrawaddi) and 1691/4 (from Kumaon).

XXII.—NOTES ON RAIMANNIA AND ALLIED GENERA.

T. A. Sprague and L. A. M. Riley.

The genus *Oenothera*, as founded by Linnaeus in 1753, included three species, *biennis*, *mollissima* and *fruticosa*.* Many others, some of very different type, were added during the next 80 years, and *Oenothera* became so comprehensive that in 1835 Spach divided it into fifteen genera.† Eight of these were reduced by Endlicher‡ in 1840, and the remaining ones by Bentham and Hooker in 1862.§ Raimann, however accepted Spach's genera in his revision of the *Onagraceae*, published in 1893‖; and Small adopted the same classification in 1896.¶

Spach restricted *Oenothera* to *Oe. mollissima* and its allies, and placed *biennis* and *fruticosa* in *Onagra* and *Kneiffia* respectively. Rose pointed out, in 1905** that *biennis* should be regarded as the nomenclatural type of *Oenothera*. That this view is correct is evident from the following considerations.

1. Linnaeus based *Oenothera* on *Onagra*, Tourn. Inst. i. p. 302, t. 156. Tournefort included in his description the phrase "seminibus ut plurimum angulatis," which is applicable to *biennis*, but not to *mollissima* or *fruticosa*. Linnaeus also described the seeds as angled.

2. *Oe. biennis* was better known to Linnaeus than either *mollissima* or *fruticosa*, being common in Europe, both as a naturalized plant and in gardens.

3. It was included by Linnaeus in his Hortus Upsalensis and Hortus Cliffortianus.

Such considerations are in accordance with Art. 19 and 45 of the International Rules, and are recognised as valid in the American Code, which is more explicit.

Onagra, Adans., being a synonym of *Oenothera*, Linn. (emend.), Rose proposed the new generic name *Raimannia* for *Oenothera*, Spach. He cited *Oe. laciniata* as the type species. But if "the publication of a new generic name as an avowed substitute for an earlier invalid one does not change the type of a genus,"†† *Oe. mollissima* should be regarded as the type of *Raimannia*.

The three genera *Oenothera*, *Raimannia* and *Anogra* (*Onagreae-Oenotherinae*) are closely allied, and to a certain extent con-

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* Sp. Pl. ed. 1, p. 346; Gen. Pl. ed. 5, p. 163.

† Hist. iv. p. 353; Ann. Sc. Nat. sér. 2, iv. p. 164: Nouv. Ann. Mus. Hist. Nat. iv. p. 341.

‡ Gen. Pl. p. 1190.

§ Gen. Pl. i. p. 789.

‖ Engl. et. Prantl, Nat. Pflanzenfam. iii. 7, pp. 199–223.

¶ Bull. Torr. Bot. Cl. xxiii. p. 167.

** Contrib. U.S. Nat. Herb. viii. p. 330.

†† Bull. Torr. Bot. Club, xxxiv. p. 173; Science, n.s. xlix. p. 334 (1919).

nected by aberrant species. Typical species have the following characters :

Oenothera. Flower-buds erect. Flowers nocturnal. Petals yellow. Ovules horizontal, 2–4-seriate. Seeds prismatic.
Raimannia. Flower-buds erect. Flowers nocturnal. Petals yellow. Ovules ascending, biseriate. Seeds subterete.
Anogra. Flower-buds drooping. Flowers diurnal. Petals white, turning pink. Ovules ascending, uniseriate. Seeds subterete.

It will be seen that *Raimannia* has certain characters of *Oenothera* and others of *Anogra*. *Oenothera* has horizontal ovules and strongly angled seeds, whereas *Raimannia* and *Anogra* have ascending ovules and subterete seeds. On the other hand *Oenothera* and *Raimannia* have erect flower-buds and yellow flowers, while *Anogra* has drooping flower-buds and white or pink flowers.

Oenothera (*Onagra*) was stated by Raimann to be confined to North America, but it is represented in the Andes of Bolivia and Peru by at least four species, *Oe. coccinea*, Britton,* *Oe. fusca*, Sprague et Riley, comb. nov. (*Onagra fusca*, K. Krause), *Oe. serratifolia*, K. Krause, and *Oe. scabra*, K. Krause.† Britton stated that *Oe. coccinea* is related to *Oe. mollissima* (*Raimannia mollissima*), but the horizontal quadriseriate ovules, and the cylindric-ovoid capsule with compressed seeds clearly indicate it to be a true *Oenothera* (*Onagra*). He described the flowers as "coccinei," but it is uncertain whether this was from field-notes or from dried specimens. It should be remembered that the yellow colouring of the petals in these genera frequently changes to pink on drying.

Krause placed *Oe. serratifolia* and *Oe. scabra* in *Oenothera*, Spach (*Raimannia*). That they should be referred to *Oenothera*, Linn. (*Onagra*) is evident from the horizontal quadriseriate ovules, and the shape of the young capsules.

Among the aberrant species *Raimannia mexicana* appears to have drooping buds, judging from herbarium specimens, agreeing in this respect with *Anogra*, but it has the yellow flowers and biseriate ovules of *Raimannia*. On the other hand *Anogra coronopifolia* has the biseriate ovules characteristic of *Raimannia*, to which genus Rose referred it; but its nodding buds, purplish flowers and general habit point to a closer relationship with *Anogra*, in which it should be retained. It is evidently allied to *A. albicaulis*, Britton.

No great importance can be attached to the diurnal or nocturnal expansion of the flowers as a generic character. The flowers of *Raimannia* are generally described as nocturnal and those of *Anogra* as diurnal. But a *Raimannia* collected in Patagonia by Mr. J. L. Williams Andrews has diurnal flowers :

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* Bull. Torr. Bot. Club, 1890, xvii. p. 213.
† Fedde, Repert. i. pp. 167–8 (1905).

"the blossom closes at evening and only reopens in the morning after the sun has commenced to shine"; and, according to Jepson* *Anogra californica* has vespertine flowers, remaining open two or three hours in the morning, or on a cloudy day until noon. Wooton and Standley describe the flowers of *Anogra* as nocturnal.†

Certain authors describe the seeds of *Raimannia* as being "crowned by a tubercle," but this appears to be a character confined to a few species.

The principal synonymy and a generic description of *Raimannia* are given below, followed by an enumeration of species referred to the genus by the writers. The list is not exhaustive, as it does not seem desirable to include certain little-known species of which no authenticated material has been available for examination.

Raimannia, *Rose* in Contrib. U.S. Nat. Herb. viii. p. 330 (1905); Britton et Brown, Ill. Fl. ed. 2, ii. p. 596 (1913). Wooton et Standley in Contrib. U.S. Nat. Herb. xix. p. 470 (1915). *Oenothera*, Spach, Hist. iv. p. 353 (1835); et in Ann. Sc. Nat. sér. 2, iv. p. 164 (1835); Raimann in Engl. et Prantl, Nat. Pflanzenf. iii. pt. 7, p. 214 (1893); Small in Bull. Torr. Bot. Club, 1896, xxiii. p. 172; Reiche, Fl. Chile, ii. p. 256 (1898); Small, Fl. S.E.U.S. ed. 2, p. 840 (1913).

Alabastra erecta, rarius nutantia. *Flores* tetrameri, nocturni, rarius diurni. *Hypanthium* elongatum, subcylindricum. *Sepala* reflexa, decidua. *Petala* lutea, exsiccando plus minusve rubescentia. *Stamina* 8, aequalia; antherae medifixae, versatiles, lineares; pollinis grana solitaria. *Ovarium* 4-loculare; ovula ascendentia, 2-seriata. *Capsula* linearis vel lineari-oblonga, quadrangularis, loculicide dehiscens, columna centrali. *Semina* numerosa, subteretia.—Herbae caulescentes, foliis alternis, floribus axillaribus vel spicatis.

Species 20–30, Americae borealis, Mexici et Americae australis incolae. Typus: *R. mollissima* (Linn.) Sprague et Riley.

Enumeratio Specierum.

R. Berteriana, *Sprague et Riley,* comb. nov.—*Oenothera Berteriana,* Spach.

R. colimae, *Rose.*

R. confusa, *Rose.*

R. coquimbensis, *Sprague et Riley,* comb. nov.—*Oenothera coquimbensis,* C. Gay.

R. Curtissii, *Rose.*

R. Drummondii (*Hook.*), *Rose.*

R. grandis (*Britton*), *Rose.*

R. heterophylla (*Spach*), *Rose.*

R. humifusa (*Nutt.*), *Rose.*

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* Fl. W. Mid. Calif. ed. 2, p. 282 (1911).

† Contrib. U.S. Nat. Herb. xix. p. 467 (1915).

R. indecora, *Sprague et Riley*, comb. nov.—*Oenothera indecora*, Camb.

R. laciniata (*Hill*), *Rose.*

R. littoralis (*Schlecht.*), *Rose.*

R. longiflora, *Sprague et Riley*, comb. nov.—*Oenothera longiflora*, Jacq.

R. macrosceles (*A. Gray*), *Rose.*

R. mendocinensis, *Sprague et Riley*, comb. nov.—*Oenothera mendocinensis*, Gill.

R. mexicana (*Spach*), *Woot. et Standley.*

R. mollissima, *Sprague et Riley*, comb. nov.—*Oenothera mollissima*, Linn.

R. nocturna, *Sprague et Riley*, comb. nov.—*Oenothera nocturna*, Jacq.

R. odorata, *Sprague et Riley*, comb. nov.—*Oenothera odorata*, Jacq.

R. Punae, *Sprague et Riley*, comb. nov.—*Oenothera Punae*, Kuntze. *Oe. Mandoni*, Léveillé. *Oe. Kuntziana*, Léveillé.

R. rhombipetala (*Nutt.*), *Rose.*

SPECIES EXCLUDENDA.

R. coronopifolia, Rose = **Anogra coronopifolia,** *Britton.*

XXIII.—THE GENUS THERORHODION.

J. HUTCHINSON.

For some time the writer has held the opinion that the curious and rare plant met with in a few of our gardens under the name *Rhododendron camtschaticum*,* Pall., would be better regarded as a separate genus from *Rhododendron* proper. This treatment has been accorded it by Mr. J. K. Small in the North American Flora, vol. 29, pt. i, p. 45 (1914), wherein Maximowicz's section *Therorhodion* is raised to generic rank. Mr. Small describes a new species, "*Therorhodion glandulosum*, Standley," from near Port Clarence, Alaska, distinguished from *T. camtschaticum* by its leaves being glandular-ciliate and its glabrous corolla with relatively longer lobes than tube. This species is not so far represented in our collections at Kew. To these two species should be added a third, *Therorhodion Redowskianum*, Hutchinson, a Manchurian plant described by Maximowicz as *Rhododendron Redowskianum*. This species has a curious botanical history. As far back as 1826, in the first volume of "Linnaea" (p. 513), it was identified by Chamisso and Schlechtendal with a European plant, *Rhodothamnus Chamae-*

* This is the original spelling; later authors have generally spelled it *kamtschaticum*.

cistus, Rchb. (*Rhododendron Chamaecistus*, L.), now known to be confined to the Eastern Alps (and Southern Translyvania ?), to which it bears a very close external resemblance. This erroneous determination was also recorded by H. E. M. James in the list of plants appended to his account of a journey in Manchuria entitled "The Long White Mountain," p. 458 (1888). James collected the plant between Mukden and Kirin.

Therorhodion camtschaticum occurs on both sides of the Behring Straits, *T. Redowskianum* in Eastern Manchuria (*see also* p. 205), and *T. glandulosum* in North West Alaska. The genus differs from *Rhododendron* proper by the flowers being borne on the young leafy shoots, and not in special buds as in the case of all true *Rhododendrons*, and in the unilaterally split corolla-tube. In the case of *Therorhodion Redowskianum* especially, and to a much less extent in that of *T. kamtschaticum*, the style (*see* Fig. 1) is very early abruptly reflexed from the base and projects through the sinus of the split corolla-tube, thus entirely removing its stigmatic surface from the stamens and effectively preventing self-fertilization. One might reasonably suppose that during the course of evolution of this interesting little genus the *bending* of the style, in order to avoid self-fertilization, has been a gradual process associated with the visits of insects, and has brought about a corresponding gradual splitting of the corolla-tube.

Below is given a key to the species of *Therorhodion* with a revised description of the two species represented at Kew.

Therorhodion, *Small* in North Amer. Fl. xxix. pt. i. 45 (1914). *Rhododendron* § *Therorhodion*, Maxim. in Mem. Acad. St. Petèrsb. ser. vii. xvi. n. 9, p. 47 (1870).

Leaves not glandular-ciliate; corolla pubescent outside, the lobes much longer than the tube; calyx-lobes veiny; style nearly as long as the corolla, not reflexed ...	1. *camtschaticum.*
Leaves glandular-ciliate; corolla glabrous outside, the lobes longer than the tube	2. *glandulosum.*
Leaves glandular-ciliate; corolla glabrous outside, the lobes about as long or a little shorter than the tube; style much shorter than the corolla, abruptly reflexed and protruding through the sinus of the split corolla	3. *Redowskianum.*

1. **Therorhodion camtschaticum,** *Small*, l.c. (1914).

Rhododendron camtschaticum, Pallas, Fl. Ross. i. 48, t. 33 (1784); Hook. Fl. Bor. Am. ii. 43 (1834); Maxim. l.c. 47 (1870); Hutchinson in Bot. Mag. t. 8210 (1908). *Rhodothamnus kamtschaticus*, Lindl. in Paxt. Fl. Gard. i. t. 22 (1850). *Chamaerhododendros Berberis folio*, etc., Gmel. Fl. Sibir. iv. 126 (1769). *Rhododendron Chamaecistus*, Linnaeus, Mant. 381 (1771), quoad syn. Gmel., non pl. europ.

A low undershrub up to about 20 cm. high, usually about 12 cm.; stems curved, ascending or subdecumbent, often tinged with purple, rough with persistent leaf-bases, at first clothed with long slender subsetose hairs which are sometimes gland-tipped. *Leaves* deciduous, becoming larger in the upper part of the branch, in the lower part gradually metamorphosed into bud scales, sessile, obovate or spathulate-obovate, slightly decurrent at the base, rounded to an obtuse glandular apex, 2–5 cm. long, 1–2·5 cm. broad, chartaceous, strongly nerved and veined especially below, the nerves ascending and looped towards the apex, often setose below. *Flowers* solitary, terminating each branchlet; pedicels bearing large leafy bracts and numerous setose gland-tipped hairs, the uppermost bracts scarcely different from the calyx segments. *Calyx* lobed almost to the base, densely setose-pubescent outside; segments foliaceous, green, oblong, with an obtuse glandular apex, 1–1·8 cm. long, 4–5 mm. broad, strongly nerved, setose outside and on the margin. *Corolla* about 2·5 cm. long, carmine-purple; tube split to the base or nearly so on one side, about $\frac{1}{3}$ as long as the lobes, pubescent outside; lobes oblong-elliptic, rounded at the apex, pubescent outside, spotted within. *Stamens* 10, declinate, the longest as long as the corolla; filaments very unequal, densely pubescent towards the base, purple-red; anthers nearly black, very broad. *Ovary* 5-celled, broadly ovoid, pubescent; style nearly as long as the corolla, curved, purple-red, villous-pilose towards the base; stigma depressed-capitate, slightly 5-lobed. *Capsule* narrowly oblong-ellipsoid, 5-lobed, scarcely 1 cm. long, shortly pubescent. *Seeds* very small, scarcely 0·5 mm. long, oblong-elliptic, flat.

Distribution.—In muddy mountainous places on both sides of Bering Straits and on the shores of the sea of Okhotsk, including Sakhalin, Kurile Islands, northern Japan (Yezo N.E. Hondo); in Alaska as far south as Bank's Island.

In its native habitat this charming little plant blossoms from the end of July and ripens its seeds about the end of September. In the British Islands, therefore, it should be grown in as cold a situation as possible, preferably under a north wall. Otherwise it is apt to premature growth, and is liable to be damaged by late spring frosts.

2. **Therorhodion glandulosum,** *Standley ex Small*, l.c. (1914).

"A low shrub forming dense clumps about 1 dm. tall, usually copiously branched; leaf-blades spathulate, often broadly so. or oval or ovate, on the upper part of the branches, 1–2 cm. long or less, obtuse, often rounded and abruptly pointed, or sometimes acute at the apex, crenulate, glandular-ciliate, veiny, somewhat shining, sessile or nearly so; calyx-lobes oblong, often narrowly so, to elliptic-oblong, 8–10 mm. long in anthesis, glandular-pubescent and glandular-ciliate; corolla rose-purple, 2 cm. long or slightly shorter, glabrous, the lobes somewhat erose,

eciliolate; capsules oval, 7–9 mm. long, pubescent with short white hairs."

DISTRIBUTION.—Foot of Kigluaik Mountains, near Oogluk Bay, Imuruk Basin, Alaska (type in U.S. Nat. Herb.).

3. **Therorhodion Redowskianum,** *Hutchinson*, comb. nov.

Rhododendron Redowskianum, Maxim. Prim. Fl. Amur. 189 (1859) et l.c. 48, t. ii. Fig. 21–25 (1870); Komarov, Fl. Manshur. iii. 208 (1907). *Rhododendron Chamaecistus*, Cham. et Schlt. in Linnaea, i. 513 (1826); James, "The long White Mountain," 458 (1888); non Linn.

FIG. 1.

Therorhodion Redowskianum, Hutchinson
(nat. size, floral parts enlarged).

A low shrublet about 10 cm. high, branched from the base; older branches covered with smooth light grey bark, rough

with the persistent bases of the leaves; young branches very short, leafy, thinly setose with gland-tipped hairs. *Leaves* deciduous, crowded, spathulate-oblanceolate, attenuated to the subdecurrent base, with a thick obtuse gland at the subtriangular apex, 0·5–1·5 cm. long, 3–6 mm. broad, chartaceous, with conspicuous nerves on the lower surface, prominently ciliate with gland-tipped hairs. *Flowers* solitary or up to three on each young shoot; pedicel with several small leafy bracts, finely puberulous and with a few scattered gland-tipped hairs. *Calyx* 5-lobed to the base; segments linear-oblong, obtuse, about 5 mm. long and 1·75 mm. broad, finely puberulous outside, ciliate with gland-tipped hairs. *Corolla* about 1·5 cm. long, split to the base on one side, glabrous; tube 7–8 mm. long; lobes broadly oblong, crenulate, 6 mm. long, 5 mm. broad. *Stamens* 10, a little longer than the tube; filaments pubescent in the lower third; anthers broad, about 1·5 mm. long. *Ovary* densely pubescent; style abruptly reflexed through the sinus of the corolla, 5 mm. long, pubescent in the lower half; stigma discoid, lobulate. *Fruits* not seen.

Distribution.—Manchuria and according to Komarov, l.c., through Kamtschatka into Alaska. The plant from the latter place, however, may be that described by Small as *T. glandulosum*. I have seen only the specimen collected by James in Manchuria.

XXIV.—A REVISION OF THE GENUS CAPRARIA.

T. A. Sprague.

The genus *Capraria* (*Scrophulariaceae-Digitaleae*) comprises five species endemic in tropical and subtropical America. All are undershrubs with alternate more or less serrate leaves, regular or somewhat bilabiate corolla and five or four stamens. The capsule is septicidal with a large central column, and each valve splits more than half way down the dorsal suture. The commonest species, *C. biflora*, Linn., has become naturalized in the Cape Verde Islands, the Gold Coast and Mauritius, but unlike many tropical American weeds has not yet reached Indo-Malaya or Polynesia.

The closest relationship of *Capraria* is with *Scoparia*; both genera possess pellucid-dotted leaves, the dots being due to the presence of external peltate glands which are imbedded in small depressions in the surface of the leaf. In Bentham and Hooker's Genera Plantarum *Scoparia* and *Capraria* are placed side by side, but in Wettstein's arrangement in Engler u. Prantl, Nat. Pflanzenfam., the Asiatic genus *Hemiphragma*, which has relatively little in common with either, is intercalated between them. This is due to his adoption of an analytical classification, in which the alternate-leaved genera precede the opposite-leaved ones.

The history of *Capraria* commences in 1689, when *C. biflora* was mentioned by Paul Herman* and Jacob Breyne† as a rare plant cultivated in botanic gardens in Holland. Herman gave it the name *Capraria Curassavica*, the generic name indicating that the plant was eaten by goats, and the trivial that it was a native of the island of Curaçao. Breyne called it *Gratiolae affinis frutescens Americana, foliis Agerati, seu Veronicae erectae majoris.*

Commelin‡ published a description and coloured figure of the plant in 1697, and mentioned that in 1690 a box of the dried leaves prepared in the manner of tea came into his hands. This had been taken from a French prize brought from the West Indies. Characteristic woodcuts were given by Plukenet in 1691,§ and Herman in 1698;‖ the former proposed the specific phrase *Lysimachiae purpureae affinis Americana procumbens, Anonidis Vernae frutescentis, folio singulare glabro.*

The species was known in Curaçao as Cabritten-Kruid, Cabritien-Kruidt, Cabritta and Cavritta, the last being the Portuguese form of the name.

The fact that *C. biflora* yielded a kind of tea was known in Jamaica at least as early as 1680. Barham, writing in 1711, stated that "the virtue of this herb . . . hath been known with us above thirty years."¶ It cannot, however, have been in general use, judging from Sloane's remark in 1707: "Why some give it the name of Thea, I cannot imagine."**

Labat,†† who visited Guadeloupe and Martinique in 1696 found "wild tea" growing in abundance, and gave a long account of the plant, its preparation and use; his description leaves no doubt that it was *Capraria biflora*. He thought that it was identical with China tea, a belief which survived in the West Indies to the middle of the eighteenth century, when N. J. Jacquin stated that he could hardly convince the colonists to the contrary.‡‡

A second species was described by Feuillée in 1714 under the name *Capraria peruviana, Agerati foliis absque pediculis.* This grew on islands of the river Rimac at Lima, Peru. Feuillée stated that it first became known in Peru in 1709, and that it possessed the same properties as East Indian tea, so that the Peruvians soon abandoned the use of the latter.§§

Linnaeus adopted the generic name *Capraria*, and at first regarded the Peruvian species as being the same as the West

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* Herman, Parad. Bat. Prodr. p. 319 (1689).
† Breyne, Prodr. ii. p. 54 (1689).
‡ Commelin, Hort. i. p. 79, t. 40 (1697).
§ Plukenet, Phytogr. t. 98 f. 4 (1691); Alm. p. 237 (1696).
‖ Herman, Parad. Bat. p. 110, t. 110 (1698).
¶ Barham, Hortus Americanus, p. 187 (1794); Dict. Nat. Biogr. iii. p. 187.
** Sloane, Nat. Hist. Jamaica i. p. 210 (1707).
†† Labat, Voy. i. part 2, p. 340 (1724).
‡‡ N. J. Jacquin, Hist. p. 182 (1763).
§§ Feuillée,-Obs. ii. p. 764, t. 48 (1714).

Indian,* but was afterwards inclined to separate them.† In 1737 he recognised two species of *Capraria*, the first being based on *Capraria Curassavica*, Herm., and the second founded on *Veronica Americana erecta frutescens*, Herm. Parad. p. 241, t. 241; but in 1748 he made the latter the type of a new genus *Scoparia*.‡

Little need be said of the history of *Capraria* since 1753. Ruiz and Pavon re-described *C. peruviana*, and made it the type of a new genus *Xuarezia* on account of its flowers being pentandrous;§ and the same character led W. J. Hooker to describe it as a new species of *Witheringia* (*Solanaceae*).‖

A third species was described by Miller in 1768 from Vera Cruz, Mexico, as *Erinus frutescens*,¶ was re-named *Capraria cuneata* by Robert Brown,** and re-described as *C. saxifragaefolia* by Chamisso and Schlechtendal in 1830.†† On the last was based the genus *Pogostoma*, Schrad.,‡‡ now regarded as a synonym of *Capraria*.

The fourth species, *C. integrifolia*, Mart. et Gal.,§§ was not published until 1845. It was collected by Galeotti on the Cordillera of Oaxaca, and does not appear to have been re-discovered. The leaves are described as entire, and the corolla as hardly longer than the calyx.

Bentham described a fifth species, *C. mexicana*, Moric., in 1846.‖‖ This has lanceolate acute corolla-lobes, twice as long as the tube.

Capraria lanceolata, Vahl (1789) and *C. hirsuta*, H.B.K. (1817), appear to be mere forms of *C. biflora*, which is very variable, according to Pennell.¶¶

There remain nearly thirty names under *Capraria* which are referable to other genera and families. These will be found in the list of excluded species at the end of the article.

Capraria, [*Herm.* Parad. Bat. Prodr. p. 319 (1689); Parad. Bat. p. 110 (1698); Feuillée, Obs. ii. p. 764 (1714); Linn. Hort. Cliff. p. 320 (1737), partim] *Linn.* Sp. Pl. ed. 1, p. 628 (1753); Gen. Pl. ed. 5, p. 276 (1754); Benth. in DC. Prodr. x. p. 429 (1846); Benth. et Hook. f. Gen. Pl. ii. p. 959 (1876).

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* Linn. Hort. Cliff. p. 320 (1737).

† Linn. Sp. Pl. ed. 1, p. 628 (1753).

‡ Linn. Syst. Nat. ed. 6, p. 87 (1748); Sp. Pl. ed. 1, p. 116; Gen. Pl. ed. 5, p. 52.

§ Ruiz et Pav. Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

‖ Hook. Bot. Misc. ii. p. 231 (1831).

¶ Mill. Gard. Dict. ed. 8, No. 4 (1768).

** Ait. Hort. Kew. ed. 2, iv. p. 45 (1812).

†† Cham. et Schlecht. in Linnaea, v. p. 105 (1830).

‡‡ Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833).

§§ Mart. et Gal. in Bull. Acad. Brux. xii. pars 2, p. 20 (1845); Walp. Rep. vi. p. 645.

‖‖ Benth. in DC. Prodr. x. p. 429 (1846).

¶¶ Pennell in Proc. Acad. Nat. Sc. Philad. 1920, p. 147.

Xuarezia, Ruiz et Pav. Syst. Veg. p. 46 (1798); Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

Pogostoma, Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833); Benth. in DC. Prodr. x. p. 430 (1846).

Key to the Species.

Corolla hardly exceeding the sepals; leaves entire - - - - - - - 4. *integrifolia*.

Corolla considerably longer than the sepals;
- Corolla-lobes much shorter than the tube; pedicels and calyx densely glandular-pilose; stamens subdidynamous - 5. *frutescens*.
- Corolla-lobes equalling or longer than the tube:
  - Corolla subrotate; calyx-lobes half as long as the capsule - - - 1. *peruviana*.
  - Corolla not subrotate; calyx-lobes usually as long as or longer than the capsule:
    - Corolla-lobes lanceolate, acute, twice as long as the tube - - - 2. *mexicana*.
    - Corolla-lobes oblong, obtuse, as long as or rather longer than the tube - 3. *biflora*.

1. **C. peruviana,** *Benth.* in DC. Prodr. x. p. 430 (1846); Robinson in Proc. Am. Acad. xxxviii. p. 202 (1902); A. Stewart in Proc. Calif. Acad. Sc. i. p. 141 (1911).

Xuaresia biflora, Ruiz et Pav. Syst. Veg. p. 46 (1798); Fl. Peruv. ii. p. 13, t. 123, fig. a (1799).

Witheringia salicifolia, Hook. Bot. Misc. ii. p. 231 (1831).

Capraria peruviana, Agerati foliis absque pediculis, Feuillée, Obs. ii. p. 764, t. 48 (1714).

Vernacular Names.—Té del Peru. Té de Lima.

Galapagos Islands.—Charles Island, *Markham*, *Stewart* 3430 (Mus. Brit.).

Panama.—On old walls, Panamá, *Sutton Hayes* 395.

Colombia.—Without locality, *Lobb*.

Ecuador.—Guayaquil, common in savannahs by the river Daule, *Spruce* 6301.

Peru.—Village of Quiros, *Seemann* 939. Lurin, Lima *Cruckshanks* (type of *Witheringia salicifolia*). In wet places by the river Rimac, Lima, *Nation*. Valley of Santa Clara, *Barclay* (Mus. Brit.).

According to Feuillée (l.c.), the leaves of *C. peruviana* were used as tea in Peru in the eighteenth century.

C. peruviana may be distinguished from *C. biflora*, to which it is reduced in the Index Kewensis, by the regular subrotate corolla, five stamens, and sepals only half as long as the capsule. Hemsley* apparently regarded *C. peruviana* as conspecific with

* Biol. Centr.-Amer. Bot. ii. p. 455 (1882).

C. biflora, although he did not quote it as a synonym : he stated, however, that *C. biflora* extended to Peru, and identified a Panamá specimen of *C. peruviana* as *C. biflora* (in Herb. Kew).

C. peruviana has not been recorded from Colombia previously. Pennell does not include it in his enumeration of Colombian Scrophulariaceae.*

2. **C. mexicana,** *Moric. ex Benth.* in DC. Prodr. x. p. 429 (1846); Greenman in Proc. Am. Acad. xl. p. 31 (1904).

C. biflora, Hemsl. Biol. Centr.-Amer., Bot., partim, non Linn.

Mexico.—Tampico, *Berlandier*, sine numero (type), *Berlandier* 10 (Mus. Brit.), *Palmer* 188 (Mus. Brit.). Between San Luis Potosi and Tampico, *Palmer* 1125. Tamaulipas, Soto la Marina, *Nelson* 6643 (fide *Greenman*). Vera Cruz, near Tantoyuca, *Ervendberg* 184 (fide *Greenman*).

3. **C. biflora,** *Linn.* Sp. Pl. p. 875 (1753); Jacq Hist. p. 182, t. 115 (1763); Lam. Encycl. i. p. 604 (1783); Ill. t. 534, fig. 2; H.B.K. Nov. Gen. Sp. ii. p. 354 (1817); Descourtilz, Fl. Antill. iv. p. 313, t. 300 (1827); Griseb. Fl. Brit. W. Ind. p. 427 (1861); J. A. Schmidt in Mart. Fl. Bras. viii. pars 1, p. 293 (1862); Grosourdy, Med. Bot. Crioll. iii. p. 167 (1864); Ernst in Journ. Bot. 1865, p. 284; Millsp. in Publ. Field Columb. Mus., Bot. i. p. 45 (1895); l.c. 319 (1896); l.c. ii. 98 (1900); l.c. 236 (1907); Loes. in Engl. Jahrb. xxiii. p. 120 (1896); Combs in Trans. Acad. Sc. St Louis, vii. p. 449 (1897); Duss in Ann. Mus. Col. Marseille, iii. p. 403 (1897); Robins. in Proc. Am. Acad. xxxviii. p. 202 (1902); Donn. Smith in Pittier, Primit. Fl. Costaric. ii. p. 179 (1898); Loes. in Bull. Herb. Boiss. sér. 2, iii. p. 284 (1903); Pulle, Enum. Pl. Surinam, p. 416 (1906); J. R. Johnston in Proc. Bost. Soc. Hist. Nat. xxxiv. pp. 258, 276 (1909); Urb. Symb. Antill. iv. p. 560 (1911); Glaziou in Bull. Soc. Bot. France. Mém. 3, p. 509 (1911); Boldingh Fl. Ned. W. Ind. p. 361 (1913); Small, Fl. S.E.U.S., ed. 2, p. 1069 (1913); Britton, Fl. Bermuda, p. 348 (1918); Britton and Millsp. Bahama Fl. p. 391 (1920).

C. lanceolata, Vahl, Ecl. ii. p. 47 (1798).

C. semiserrata, Willd. Sp. Pl. iii. p. 324 (1800).

C. semiserrata, var *Berterii*, A. DC. in DC. Prodr. x. p. 429 (1846); Millsp. in Publ. Field Columb. Mus., Bot. ii. p. 98 (1900).

C. hirsuta, H.B.K. Nov. Gen. Sp. ii. p. 355 (1817), teste Benth. in DC. Prodr. x. p. 429.

C. mexicana, Griseb. Fl. Brit. W. Ind. p. 427 (1861), non Moric.

Capraria Curassavica, Cabiritta vulgo, Herm. Parad. Bat. Prodr. p. 319 (1689).

Capraria Corassavica, Cavritta Lusit., Herm. Parad. Bat. p. 110, t. 110 (1698).

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* Proc. Acad. Nat. Sc. Philad. 1920, p. 147.

Gratiolae affinis frutescens americana, foliis Agerati, seu Veronicae erectae majoris, Breyn. Prodr. ii. p. 54 (1689); ed. 2. p. 69 (1739); Commelin, Hort. i. p. 79, t. 40 (1697); Sloane Nat. Hist. Jamaica, i. p. 209 (1707), et l.c. ii. p. 373 (1725).

Lysimachiae purpureae affinis Americana procumbens, Anonidis Vernae frutescentis, folio singulari glabro, Pluk. Phytogr. t. 98, fig. 4 (1691); Pluk. Alm. p. 237 (1696).

Thé sauvage, Labat, Voy. i. part 2, p. 340 (1724).

Capraria foliis alternis, corollis quinquefidis, Linn. Hort. Cliff. p. 320 (1737), quoad plantam curassavicam.

Vernacular Names.—Stow-weed (Bahamas); Goat-weed (West Indies); Wild Tea (West Indies); Thé du pays, Thé muraille (Martinique, Guadeloupe); Thé de la Guadeloupe (French Guiana); Thé d'Amérique (Santo Domingo); Té del pais, Té de la tierra (Puerto Rico); Té Nacional (Colombia); Escabiosa (Cuba), Tantsji (Curacao, Aruba, Bonaire); Agrimonia silvestre, Claudiosa (Yucatan); Fregosa (Venezuela); Balsaminha (Brazil).

Tropical and Subtropical America.—Recorded from Bermuda (naturalized), Florida, Texas, Mexico, Central America, West Indies, Colombia, Venezuela, Guiana and Brazil. Apparently absent from the Pacific Coast of South America, where the genus is represented by *C. peruviana*. Naturalized in the Cape Verde Islands, the Gold Coast and Mauritius.

An infusion of the leaves of *C. biflora* has been used as tea and as a medicine in the West Indies, Colombia, Venezuela, Guiana and Brazil. When taken in moderation it acts as a gentle stimulant to the nervous system, and as a digestive tonic, but too strong doses produce general debility, loss of memory, and even paralysis.*

It is cultivated under the name Té Nacional in the Department of Boyacá, Colombia by Senor Juan T. Torero, from whom a sample of "tea" and a set of herbarium specimens have been received at Kew, through the instrumentality of Mr. T. M. Dawe. The seeds take from three to six months to germinate, according to Señor Torero.

4. **C. integrifolia,** *Mart. et Gal.* in Bull. Acad. Brux. xii. pars 2, p. 20 (1845); Walp. Rep. vi. p. 645; Hemsl. Biol. Centr.-Amer., Bot. ii. p. 455 (1882).

Mexico.—Cordillera of Oaxaca, Juquila del Sur, on gneiss rocks, 1500 m., *Galeotti* 653 (testibus *Mart. et Gal.*).

5. **C. frutescens,** *Britten* in Journ. Bot. 1907, p. 315.

Erinus frutescens, Mill. Gard. Dict. ed. 8, No. 4 (1768).

Capraria cuneata, R. Br. in Ait. Hort. Kew. ed. 2, iv. p. 45 (1812).

C. saxifragaefolia, Cham. et Schlecht. in Linnaea, v. p. 105 (1830); Loes. in Bull. Herb. Boiss. 1894, ii. p. 562; Hemsl. Biol. Centr.-Amer. Bot. ii. p. 455 (1882); Millsp. in Publ. Field Columb. Mus., Bot. i. p. 319 (1896).

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* Grosourdy, Med. Bot. Crioll. iii. p. 167 (1864).

Pogostoma saxifragaefolia, Schrad. Ind. Sem. Hort. Gott. 1831; Linnaea, viii. Litt. p. 34 (1833); Benth. in DC. Prodr. x. p. 430 (1846).

Vernacular Name.—Claudiosa (Yucatan).

Mexico.—Vera Cruz, *Houston* (type). *Schiede*. Vera Cruz, near Panuco, *Seler* (teste *Loesener*). Shores of Lake Tamiahua, *Berlandier* 157 (Mus. Brit.). San Luis Potosi to Tampico, *Palmer* 1128. San Luis Potosi, near Tancanhuitz, *Seler* (teste *Loesener*). Near the Pacific, *Beechey*. Manzanillo, *Palmer* 917. Acapulco, *Barclay* 1964 (Mus. Brit.), *Palmer*, 567. Yucatan, Izamal, abundant in open places, *Gaumer* 520 (teste *Millspaugh*). Nojcacal, *Schott* 717 (= 70) (Mus. Brit.).

Excluded Species.

C. aegyptiaca, Steud. et Hochst. ex Endl. Gen. p. 682 (1839); Steud. Nomencl. ed. 2, i. p. 278 (1840) = **Anticharis arabica,** *Endl.*

C. annua, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia annua,** *Cham. et Schlecht.*

C. arabica, Steud. et Hochst. ex Endl. Iconogr. Gen. Pl. p. xii. (1839); Nov. Stirp. Dec. p. 23 (1839) = **Anticharis arabica,** *Endl.*

C. calycina, A. Gray in Proc. Am. Acad. vi. p. 49 (1862) = **Myoporum debile,** *R. Br.*

C. crustacea, Linn. Mant. p. 87 (1767) = **Vandellia crustacea,** *Benth.*

C. diffusa, Roxb. Hort. Beng. p. 47 (1814); Fl. Ind. iii. p. 93 (1832) = **Ebermaiera thyrsoidea,** *Wall.*

C. dissecta, Delile, Fl. Égypte, p. 95, t. 32, fig. 3 (1812) = **Sutera glandulosa,** *Roth.*

C. dulcis, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia dulcis,** *Linn.*

C. durantifolia, Linn. Syst. ed. 10, p. 1116 (1759) = **Stemodia durantifolia,** *Sw.*

C. elliptica, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia elliptica,** *Cham.*

C. ericacea, Kuntze, l.c. = **Scoparia ericacea,** *Cham. et Schlecht.*

C. gratioloides, Linn. Syst. ed. 10, p. 1117 (1759) = **Ilysanthes dubia,** *Barnh.*—*I. gratioloides*, Benth.

C. gratissima, Roxb. Hort. Beng. p. 47 (1814); Fl. Ind. iii. p. 92 (1832) = **Limnophila Roxburghii,** *G. Don.*

C. humifusa, Buch.-Ham. ex Wall. Cat. n. 3883 (1831) = **Centranthera humifusa,** *Wall.*

C. humilis, Ait. Hort. Kew. ed. 1, ii. p. 354 (1789) = **Stemodia verticillata,** *Sprague*, comb. nov.—*Erinus verticillatus*, Mill. (1768). *Stemodia parviflora*, Ait. (1812). *S. arenaria*, H. B. K. (1817). *Conobea pumila*, Spreng. (1819).

C. integerrima, Miq. in Linnaea, xxii. p. 476 (1849) = **Sesamum indicum,** *Linn.* (*vide* Pulle, Enum. Pl. Surinam, p. 430).

C. lanceolata, Linn. f. Suppl. p. 284 (1781) = **Freylinia lanceolata,** *G. Don.*

C. longiflora, Thunb. Mus. Upsal. xvii. p. 150 (1794), nomen = **Freylinia undulata,** *Benth.* (*vide* Juel, Plantae Thunbergianae, p. 422).

C. lucida, Ait. Hort. Kew, ed. 1, ii. p. 353 (1789) = **Teedia lucida,** *Rudolphi.*

C. Monnieria, Roxb. Hort. Beng. p. 47 (1814) = **Herpestis Monnieria,** H. B. K.

C. montevidensis, Kuntze, Rev. Gen. pars 2, p. 459 (1891) = **Scoparia montevidensis,** *R. E. Fries.*—*S. flava*, Cham. et Schlecht.

C. multifida, Michx. Fl. Bor. Am. ii. p. 22, t. 35 (1803) = **Conobea multifida,** *Benth.*

C. multiflora, Steud. Nomencl. ed. 1, p. 149, sphalm. = **Conobea multifida,** *Benth.*

C. pusilla, Torr. in Ann. Lyc. N. York, i. p. 36 (1824) = **Mimulus floribundus,** *Dougl.*

C. rigida, Buch.-Ham. ex Hook. f. Fl. Brit. Ind. iv. p. 301 (1884) = **Centranthera hispida,** *R. Br.*

C. rigida, Thunb. Prodr. p. 103 (1800) = **Ehretia rigida,** *Druce.*—*Freylinia rigida*, G. Don. *Ehretia hottentotica*, Burch. (*vide* Dyer, Fl. Cap. iv. sect. 2, p. 5).

C. salicifolia, Salisb. Prodr. p. 94 (1796) = **Freylinia lanceolata,** *G. Don.*

C. undulata, Linn. f. Suppl. p. 284 (1781) = **Freylinia undulata**, *Benth.*

C. uniflora, Burm. f. Fl. Ind. p. 133, t. 14, fig. 3 (1768 = **Lysimachia sp.** (ex icone).

XXV.—MISTLETOE ON LIME-TREES.

L. A. Boodle.

The Common Mistletoe (*Viscum album*, L.) has been found by Tubeuf* to include three biologic (or physiological) races, two occurring on Conifers, and one on various Dicotyledons. The Dicotyledonous hosts are numerous, a list of 37 species being given for Switzerland by Coaz† in a paper on the distribution of the Mistletoe in that country. In this list, Apple, wild and cultivated, stands first as being most strongly attacked, Lime-trees being placed next in order, and then Poplars.

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* Tubeuf, Die Varietäten oder Rassen der Mistel, Naturwiss. Zeitschr. für Land- und Forstwirtschaft, vol. 5 (1907), p. 321; *see also* vol. 8 (1910), p. 12; Sorauer, Handb. der Pflanzenkrankheiten, ed. 3, vol. 2, p. 492; Heinricher, Aufzucht d. Parasit. Samenpflanzen, 1910, p. 43.

† Coaz, Naturwiss. Zeitschr. f. Land- und Forstwirtschaft, vol. 16 (1918), p. 183.

In England, also, Lime is among the more trequent hosts of the Mistletoe, and the presence of the parasite on Lime is sometimes associated with the occurrence of large swellings on some of the branches attacked. The following is a statement made by Elwes and Henry* on this subject :—" In some parts of England especially in Essex and Herts. the Lime is infested by Mistletoe, which often kills the branches and causes irregular excrescences, which sometimes have an elongated gourd-like shape."

Mistletoe is abundant on Lime-trees in the grounds of Hampton Court Palace, and the branches of these trees show swellings of various sizes, sometimes resembling a gourd in shape. The presence of the mistletoe and of the swellings on the Lime-trees at Hampton Court was noted by " A. D. " in the *Gardeners' Chronicle* in 1907.† Mr. W. Dallimore recently examined these trees, and observed that, though mistletoe appeared to be present on all the swellings, there was usually a difference between those of large and those of small size, mistletoe being conspicuous on the smaller swellings, but often hardly visible on the larger ones, when viewed at a little distance.

A similar difference was shown by four specimens cut from these trees and sent to Kew for examination. One of these has a large swelling, the swollen portion being about eight inches in diameter, while the three other specimens are considerably smaller. In the case of the three smaller specimens, there is a fairly well developed growth of leafy stems of mistletoe (4 to 14 inches high), on the enlarged part of the Lime-branch, while on the large specimen only diminutive sprouts and the broken stumps of some small stems of mistletoe are to be found. An example similar to the last is presented by a specimen, in Museum IV. at Kew, of a large swelling on a branch of Lime from Windsor. In this case also, mistletoe is present, but very inconspicuous, close inspection being required to find a certain number of small shoots, and bases of others that have been broken off.

In the four specimens from Hampton Court, mistletoe is present in the swollen regions, that is to say, besides the aerial stems and leaves of the parasite, there are :—(1) a number of the so-called cortical roots, running for the most part longitudinally in the Lime-branch just outside the cambium of the latter; and (2) numerous peg-like outgrowths from the inner face of the cortical roots, called " sinkers," " borers " or " haustoria." These project radially for some distance into the wood, and thus cause interruptions in the cambial layer of the host-plant. In the specimen of a large swelling from Hampton Court numerous dead sinkers were found in the wood. To judge from

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* Elwes and Henry, Trees of Great Britain and Ireland, vol. 7, p. 1672.

† Gard. Chron., ser. 3, vol. 41, p. 240.

the abundance and character of these, it appears probable that this enlarged portion of the branch bore well-developed plants of mistletoe some years ago. Moreover it was seen, on stripping off the bark, that fairly numerous roots and sinkers of mistletoe, in a living condition, were present in this specimen, although there was such a poor external growth of the parasite.

The conclusion derived from an examination of the specimens from Hampton Court is that, in these, enlargement of the branch is due to the presence of mistletoe. Further, the general supposition may be made that, where large swellings on branches of Lime bear mistletoe of meagre growth, vigorous plants of the parasite were present during the earlier stages of the enlargement, but that they may have since disappeared, perhaps having been torn off by the wind, after they had caused some cankering of the branch, and thereby loosened their hold. Though living roots, sinkers and buds of the parasite may be present in large swellings on the Lime, there would appear to be some condition usually inhibiting any strong aerial growth of mistletoe. Possibly the thickness of the bark or the nature of the cork-layers of the Lime at this stage of the enlargement may be unfavourable to the development of the aerial stems of the mistletoe.

In some parts of the specimens examined, the influence of the parasite in causing enlargement is clearly indicated. For instance, local enlargements were seen following the course of some roots and sinkers, which extended beyond the general limit of the swelling. Enlargement depends on increased breadth of the annual rings of the wood, and, to a small extent, on thickening of the bark. The influence of sinkers in inducing the formation of enlarged annual rings in the wood of the host was noted by Pitra,* and earlier by Schacht (quoted by Pitra). Pitra suggested by way of explanation that the streaming of sap towards the roots and sinkers of the mistletoe, due to the osmotic power of the latter, might cause an increased supply of nutritive material to be available for the adjacent cambial layer of the host.

Some such cause may favour the rapid growth of wood in the neighbourhood of sinkers and roots during the earlier stages in the formation of the swelling, but there is another factor which perhaps may become important in the later stages. Owing to the disturbance of the cambial growth by sinkers and by the healing of canker-spots (opposite dead sinkers, etc.), the later formed wood and bast attain the type of structure found in burrs,† the grain running in various directions at different points. The presumable effect of this confused and often intricate course of the conducting elements would be a slow longitudinal transference of sap, and consequent congestion of food materials, in the swollen region, locally increased cambial growth being

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* Pitra, Bot. Zeitung, vol. 19 (1861), p. 64.

† This was clearly seen in the large specimen from Hampton Court.

thus favoured. One may suppose, to express the matter differently, that the burr- or bird's-eye-type of structure, while making longitudinal conduction more difficult, will scarcely reduce facilities for conduction in a radial direction, *i.e.*, towards the cambium. Hence one may regard the supply of nutriment to this tissue as being rendered *relatively* somewhat easier than in normal wood and bast. A similar suggestion may be made with regard to ordinary burrs on the stems of various trees, namely, that one of the factors concerned in the progressive enlargement of the burr may be the special structure of the wood and bast* as affecting conduction. Other factors may be more directly connected with the presence of numerous arrested adventitious buds or roots.

The four specimens from Hampton Court show some diseased wood continuous with the remains of dead branches, decay having gone so far in the large specimen that a central cavity (inhabited by wood-lice) extended through part of the swelling. A little diseased wood also immediately surrounds many of the dead sinkers individually, or forms a confluent patch where they are crowded. The occurrence of diseased wood, other than that in the mistletoe-cankers, appears to have played no part in the origin of the swellings, but, when an enlargement has been formed, decay of a considerable tract of the inner wood might favour more rapid enlargement by causing the flow of sap to be confined to the outer wood, *i.e.*, the region of the wood showing more or less burr-like structure owing to the action of the mistletoe. Possibly most of the large swellings on the Lime may have a hollow centre, but data are not available on this point.

Elwes†, when referring to the occurrence of burr-like swellings and of mistletoe on branches of Lime-trees in Essex, stated that "no mistletoe was now present on many of the branches so malformed," but expressed the opinion that the occurrence of the swellings "might be wholly or partially due to the arrested growth of the branch where the mistletoe had taken root on it." Possibly the branches described as bearing no mistletoe may have been viewed at a little distance, in which case diminutive sprouts of mistletoe might have been overlooked. Perhaps, on the other hand, the aerial shoots of the parasite may completely disappear in some cases.

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* Enlarged medullary rays form a frequent character of these burrs as well as the contorted grain.

† Elwes, Gard. Chron., ser. 3, vol. 41 (1907), p. 224.

XXVI.—DECADES KEWENSES.

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS CIII.

1021. **Biophytum insigne,** *Gamble* [Geraniaceae-Oxalideae]; species inter omnes alias regionis indicae orientalis adhuc cognitas foliolis magnis nervis subregularibus in marginem incrassatum desinentibus insignis.

Suffrutex humilis, caule erecto rugoso fere nigro, aliquando apicem versus in 2–4 ramulos diviso. *Folia* ad apicem caulis conferta, stipulis multis lineari-laceolatis strigoso-hirsutis munita, paripinnata, circiter 10 cm. longa, rhachi communi basi 2–4 cm. longa nuda parce villosa supra canaliculata; foliolorum paria 7–10, inferiora minora, ovata, media longiora, ultima 1 vel 2 oblonga, basi inaequalia, subcordata, ad 3·5 cm. longa, 1–1·5 cm. lata, mucronata, subtus parce villosa, costa media nervis primariis rectis circiter 10–12 in marginem incrassatum desinentibus, secundariis 1–2 vel pluribus additis. *Scapi* 2 vel plures inter folia orti, graciles, ad 3 dm. longi, umbellis terminalibus 8–12-floris, bracteis parvis multis lanceolatis villosis; pedicelli filiformes, ad 5 mm. longi. *Calycis* lobi 5, lanceolati, pubescentes, nervis 5–7, marginibus scariosis. *Petala* 5, connata, flava, 5–7 mm. longa. *Filamenta* villosa. *Capsula* ellipsoidea, villosa, 4 mm. longa. *Semina* minuta, rubra, tuberculis spiraliter conjunctis ornata.

S. India Tinnevelly District, in sholas, in cool and shady places, near Kodamadi above Mundanthorai, *K. Rangachari*, March 15, 1917, *C. C. Jacob*, Feb. 6, 1921, Madras Herb. no. 14618.

1022. **Rhamnus pentapomica,** *Parker* [Rhamnaceae–Rhamneae]; a *R. persica*, Boiss., foliis saepe majoribus, rima seminis apice marginibus non introflexis differt.

Frutex vel arbor parva. Foliis deciduis, ramulis breviter velutinis, nonnunquam apice spinescentibus. *Folia* 1·5–5 cm. longa., 0·6–2 cm. lata, oblonga, elliptico-lanceolata vel elliptico-oblanceolata, apice et basi attenuata, supra glabra, subtus minute velutina, remote crenulata vel integra; petiolus 2–10 mm. longus, breviter velutinus. *Flores* breviter pedicellati, fasciculati. *Calycis* laciniae triangulares. *Petala* minuta, oblanceolata. *Discus* velutinus. *Stylus* 2–4-partitus. *Drupa* 5 mm. longa, nigra, obovoideo-globosa. *Semina* nitida, eleganter verrucosa, rima hiante margine cartilaginea—*R. persica*, Lawson in Hook. f. Fl. Brit. Ind. i, 638, ex parte, non Boiss.

N.W. India. Baluchistan, Salt Range, and outer Himalaya 600–1500 m. as far east as Garhwal. Baluchistan, *Lace* 3690; N.W. India, *Aitchison* 310; 1036; *Stewart* 42; *Edgeworth* 360; *Jerram*, Rawalpindi, Jhelum, *Jowala Pershad*, 48.

1023. **Rhamnus prostrata,** *Jacquem.* Journ. ii. 346, (1841) in obs., nomen; ex *R. N. Parker* [Rhamnaceae–Rhamneae]; a *R. persica*, Boiss. habitu et disco glabro differt.

Frutex nanus, intricatus, ramis tortuosis, ramulis junioribus breviter tomentellis apice spinescentibus. *Folia* decidua 0·7–1·5 cm. longa, elliptica, obtusa, utrinque minute tomentella vel fere glabra, obscure crenulata; petiolus 1–3 mm. longus. *Flores* breviter pedicellati, fasciculati. *Calyx* cupuliformis, laciniis ovato-triangularibus. *Petala* anguste linearia, minuta. *Discus* glaber. *Stylus* 3-fidus. *Drupa* 5 mm. longa, nigra, obovoideo-globosa. *Semina* nitida, eleganter verrucosa; rima anguste hians, margine cartilaginea, apice introflexa, bifida. *R. persica*, Lawson in Hook. f. Fl. Brit. Ind. i. 638 ex parte, non Boiss.

N. W. Himalaya. In the arid region at 2700–4200 m. Garhwal, *Strachey* and *Winterbottom* 7; Kunawar 24–8–47, Spiti 30–8–47, Padar 20–6–48, Ladakh 5–7–48, Zanskar 28–6–48, Nubra 10–8–48, *T. Thomson*; Safed Koh, Afghanistan, *Aitchison* 915.

I have not seen a specimen of Jacquemont's but there is no doubt as to the plant he refers to, as T. Thomson's specimen collected on 30–8–47 came from the same locality.

1024. **Potentilla sericophylla,** *Parker* [Rosaceae–Potentilleae]; affinis *P. lignosae*, Willd. et *P. Lindenbergii*, Lehm., ab prima habitu, sepalis exterioribus et interioribus subaequalibus et capellis, ab secunda foliolis omnibus subintegris utrinque sericeo-pilosis et floribus majoribus differt.

Frutex nanus; rami stipulis persistentibus obtecti. *Folia* petiolata, non articulata, (petiolo incluso) 2–5 cm. longa; stipulae petiolo adnatae, scariosae, amplexicaules. *Foliola* 7 vel 9, nonnunquam 5·5–15 mm. longa, oblanceolata, obscure denticulata, apice rotundata, utrinque (praecipue infra) sericeo-pilosa. *Flores* 1·5–1·8 cm. diametro, 1–4, pedunculati, ex apice ramulorum oreintes, folia superantes. *Sepala* externa lineari-lanceolata, interna ovato-lanceolata, acuta, extra sericeo-pilosa. *Petala* obovata, intergerima, calyce vix longiora, alba. *Antherae* oblongae, infra emarginatae, connectivo non dilatato. *Stylus* subbasalis, filiformis, carpello maturo duplo longior; stigma non dilatum. *Achenia* apice et dorso pilosa, basin versus glabra.

N.W. India. On rocks at 2400 m. Hazara, *Stewart* 352, *Barrett*, *Parker*; Chitral, *Barrett*.

1025. **Tricholepis Toppinii,** Dunn [Compositae-Cynaroideae]; affinis *T. tibeticae*, Hook. f., sed foliis numerosis oblongis papyraceis, capitulis nutantibus, bracteis involucrantibus longioribus, externis e basi subulatis differt.

Herba erecta, 30 cm. alta, basi sublignosa, capitulis exceptis glabra; *Caulis* ramosus, foliosus, striatus. *Folia* sessilia, lineari-oblonga, basi cuneata, 1–6 cm. longa, fere ad capitula gradatim decrescentia, cuspidato-dentata, inferiora obtusa, basi saepe paullo pinnatifida. *Capitula* ovoidea, in caule ramisque solitaria, mox nutantia, basi rotundata, 3 cm. longa, 2·5 cm.

diametro. *Bracteae* involucrales, pluriseriatae, interiores anguste lineares, pubescentes, exteriores capilliformes glabrae, squarrosae, in alabastro in penicillum purpureum confertae, extremae breviores. *Corolla* purpurea, tubiformis, 2 cm. longa, dimidio superiore ampliato; laciniae 5, lineares, obtusae, 4–5 mm. longae. *Antherae* basi sagittatae, caudicibus gracilibus laceratis; filamenta puberula. *Styli* rami longi. *Achaenia* laevia. *Pappi* setae internae ad mediam corollam attingentes, barbellatae, exteriores breviores.

India. Kashmir: Ziarat; near Chitral, at 2700 m., August 1909, *Toppin* 603.

1026. **Begonia** (**Gireoudia**) **trigonoptera,** *Sprague* [Begoniaceae]; affinis *B. heracleifoliae*, Cham. et Schlecht., a qua ovarii corpore oblongo ala triangulari recedit.

Caudex brevissimus, crassus. *Folia* ultra 12, ascendentia, longipetiolata, palmatifida; petioli 1·5–1·8 dm. longi, pluricostati, costis pilis hyalinis deflexis singulis vel geminis instructis, rubro-guttati, apice annulo denso pilorum, pilis deflexis subulatis hyalinis basi rubris; lamina ad vel ultra medium palmatim sexloba, basi cordata, sinu angusto acuto propter convexitatem loborum exteriorum mox ampliato, supra glabriuscula, nigrescenti-maculata, subtus rubro-maculata. margine et nervis subtus sparse longe pilosa; lobi lanceolati, grosse serrato-dentati, acuti, laterales subfalcati, extimi saepe extrorsum lobulati; stipulae deltoideae, hyalinae, apice setiferae, circiter 1·5 cm. longae, 5 mm. connatae. *Inflorescentia* tota circiter 4·5 dm. longa, pedunculo 3 dm. longo longipiloso rubro-maculato maculis sublinearibus; cymae quinquies vel sexies furcatae, floribus masculis terminalibus, foemineis axillaribus. *Bracteae* ovatae, interdum cuspidatae, subfoliaceae, ad 1·5 cm. longae, valde concavae, conchiformes. *Flores masculi*: pedicelli 1·3 cm. longi, dense breviter glanduloso-pilosi. *Sepala* 2, obovata, 1·2–1·4 cm. longa, 9 mm. lata, extra quadrante infima pilis paucis glandulari-capitatis. *Petala* 0. *Stamina* circiter 30; antherae oblanceolato-oblongae, 1·75–2·5 mm. longae, superne 0·6 mm. latae, triente summa late introrsum dehiscentes; filamenta libera, 0·5–1 mm. longa. *Flores foeminei*: pedicelli 0·7–1·2 cm. longi. *Sepala* 2, suborbicularia, 9 mm. diametro, rosea, extra inferne pilis nonnullis glandulari-capitatis. *Petala* 0. *Ovarium* oblongum, deorsum leviter angustatum, 1·3–1·5 cm. longum, 6 mm. latum, viride, sparse roseo-punctatum, punctis pilos minutos glandulari-capitatos gerentibus; alae valde inaequales; ala princeps triangularis, decurrens, obtusa, rosea, 7 mm. lata, margine superiore subhorizontali 8–9 mm. longo, margine inferiore ascendente 1·5 cm. longo; alae caeterae 1·5–2 mm. latae, deorsum angustatae. *Placentae* bilamellatae, lamellis utrinque ovuliferis; ovula numerosissima, multiseriata. *Styli* basi 1 mm. connati; rami 2·5 mm. longi; stigmata lunata.

Guatemala. Alta Verapaz: Coban. Described from a living plant presented to Kew by the Royal Botanic Gardens,

Glasnevin, where it had been raised from seed received from Mr. Harry Johnson.

Begonia trigonoptera is closely allied to *B. heracleifolia*, Cham. et Schlecht., from which the shape of the ovary-body and wings serve to distinguish it. *B. trigonoptera* has an oblong ovary with very unequal wings, the largest being conspicuously triangular, and the smaller ones very narrow. *B. heracleifolia* and its varieties have an elliptic ovary with a rounded principal wing, and comparatively broad subsidiary ones.

1027. **Symplocos Barberi,** *Gamble* [Symplocaceae]; *S. roseae*, Bedd., affinis, foliis basi rotundatis vel cordatis, margine subintegris, recemis axillaribus brevibus eximie bracteatis differt.

Arbor parva, ramulis teretibus glabris. *Folia* membranacea, oblongo-oblanceolata, apice obtusa, acuta vel aliquando acuminata, basi rotundata vel cordata, subsessilia, glabra, margine integra vel aliquando apicem versus parce mucronato-serrata, 10–13 cm. longa, 3–4 cm. lata, costa supra impressa, infra prope basim pilis paucis strigosis munita; nervi utrinque 10–12, curvati et prope marginem arcuatim juncti; petiolus circiter 4 mm. longus, strigoso-hispidus. *Racemi* axillares, pauciflori, vix 1 cm. longi, hispidi, bracteis multis ovatis ferrugineo-villosis suffulti. *Calycis* lobi ovati, ferrugineo-villosi, 2–3 mm. longi, intus glabri. *Corollae* lobi oblongi, pilis paucis prope basim muniti. *Stamina* circiter 40, contra corollae lobos in fasciculos 5 aggregata. *Stylus* simplex, apice indistincte trilobus. *Drupa* oblonga, apicem versus paullo attenuata, glabra, ad 1·5 cm. longa, calycis lobis persistentibus incurvis munita.

S. India. Hills of Tinnevelly, *R. H. Beddome*, 1866 and 1869; Kalivayalpil, Tinnevelly, June 1, 1901, *C. A. Barber* 3066.

1028. **Jasminum rex,** *Dunn* [Oleaceae-Jasmineae]; *J. nobili*, C. B. Clarke, affinis, sed foliis majoribus oblongis magis conspicue trinervibus distincta.

Frutex scandens, omnino glaber. *Rami* graciles, teretes. *Folia* opposita, unifoliolata, oblonga, apice abrupte obtuse acuminata, basi rotundata, 9–12 cm. longa, 4·5–5·5 cm. lata, integra, subcoriacea, trinervia, nervis 3 infra prominentibus, ceteris obscuris; petioli 8–9 mm. longi. *Flores* maximi, in cymas laxas paucifloras terminales dispositi; pedicelli 1·5–2 cm. longi; bracteae setaceae, 2 mm. longae, persistentes *Calyx* tubulosus; dentes 5, distantes, anguste lineares, 8–9 mm. longi, tubo 3-plo longiores. *Corolla* alba; tubus 3 cm. longus. 2 mm. latus; lobi 9, obovato-oblongi, apice rotundati, apiculati, 2·5–3·5 cm. longi, 0·8–1 cm. lati. *Antherae* 2, prope basin tubi subsessiles. *Ovarium* 2-loculare; ovula in quoque loculo 2; stylus elongatus, tubum aequans; stigma in fauce tubi, bifidum. *Bacca* (una solum visa) ovoidea, 1·4 cm. longa, 8 mm. lata; semen unicum, epicarpio tenui carnoso cinctum.

Siam.—Cultivated in Bangkok, but said to be a native of the Siamese part of the Malay Peninsula. A photograph of the whole plant was sent with dried specimens to Kew by Mr. T. S.

Sanitwongse, M.B.C.M. (Edinburgh). His report of its supposed origin is supported by its relationship to *J. nobile*, C. B. Clarke, which occurs in the neighbouring state of Tenasserim. The photograph shows a climber covered with a profusion of remarkably large white flowers, and proves Mr. Sanitwongse's Jasmine to be one of the finest species in the genus.

1029. **Celsia Layardii,** *Ball*, ex *Turrill* in Herb. Kew [Scrophulariaceae-Verbasceae]; species *C. intricatae*, Benth., affinis, sed indumento stellato-tomentoso et floribus majoribus facile distinguitur.

Herba perennis, 3·5 dm. alta, dense stellato-tomentosa. *Folia* basalia lanceolata, apice acuta, basi in petiolum usque ad 4 cm. longum angustata, 5·5 cm. longa, 2–2·5 cm. lata, grosse sinuato-dentata. *Inflorescentia* divaricata, pedicellis usque ad 1·3 cm. longis. *Calyx* 5-fidus, segmentis oblongo-lanceolatis apice subacutis 4 mm. longis 2 mm. latis extra dense stellato-tomentosis intra minute glandulosis. *Corolla* 2·2 cm. diametro, lobis suborbicularibus 6 mm. longis. *Stamina* 4, filamentis duobus 4 mm. longis usque ad apicem dense violaceo-lanatis, duobus 5 mm. longis in parte suprema glabris alioquin dense violaceo-lanatis, antheris reniformibus 1·5 mm. longis duobus pilis clavatis tectis duobus glabris. *Ovarium* dense tomentosum, 2 mm. altum, 2 mm. diametro; stylus 8 mm. longus, glaber, superne ampliatus; stigma clavatum.

Orient. Mountains of Kurdistan, *A. H. Layard* 327; Mesopotamia, hills in the neighbourhood of Ramadie and Hit, in flower, March and April 1918, *G. A. Watson.*

1030. **Aechmea chromatica,** *C. H. Wright* [Bromeliaceae-Bromelieae]; species *A. Mariae-Reginae*, H. Wendl., affinis, foliis oblanceolatis bracteisque inermibus differt.

Folia circiter 12, rosulatim disposita; vagina subrotundata, 18 cm. longa, 18 cm. lata; lamina oblanceolata, 52 cm. longa, acute mucronata, primum minute furfuracea, demum glabra, medio incurva, 6 cm. lata, infra medium plana, 7 cm. lata, dentibus inferioribus 2 mm. longis, superioribus gradatim decrescentibus instructa. *Pedunculus* 15 cm. longus; bracteae oblongo-deltoideae, inermes, coccineae, 12 cm. longae, basi 4 cm. latae; spica pedunculo aequilonga, conica; rhachis pedicellique fere nigra. *Calycis* tubus cylindricus, glaber, atrocyaneus, 7 mm. longus; lobi obliqui, contorti, mucrone valido instructi, 7 mm. longi, infra dilute violacei, supra pallide carminei. *Petala* alba, oblonga, apice rotundata, 1·4 cm. longa, 3 mm. lata, squamis fimbriatis 3 mm. longis instructa. *Stamina* petalis semilonga; antherae oblongae, albae. *Stylus* petalis fere aequilongus; stigma album, spiraliter contortum.

Tropical America.—Described from a plant which flowered at Kew in February, 1920, the history of which has been lost.

The specific name refers to the gradation of colour in the calyx, which is deep indigo at the base passing into a gradually decreasing shade of violet in the lower part of the lobes, which

are pink in their upper part. A coloured drawing has been made for the Kew collection. The leaves are widest above the middle where they are incurved.

XXVII.—MISCELLANEOUS NOTES.

Captain G. J. L. Burton has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Plant Breeder in the Department of Agriculture, Kenya Colony.

Mr. A. C. Miles.—We learn that Mr. A. C. Miles, formerly Curator of Botanic Stations (*K. B.*, 1909, p. 22), has been appointed Senior Superintendent in the Agricultural Department, The Gold Coast.

Rear-Admiral Sir Richard Massie Blomfield, K.C.M.G.—We record with regret the death of Sir Richard Massie Blomfield, in his 87th year, on June 26 at 32, Elm Park Gardens, S.W. He was an old and valued correspondent of Kew and his connection with Kew commenced in 1873 when he was a captain in the Royal Navy. In that year when he was in Japan he collected some 41 specimens and forwarded them to Kew.

He was keenly interested in Botany and Horticulture, and whilst Comptroller of the Port of Alexandria (from the institution of that office in 1879), took a great interest in the flora of Egypt. At that time he corresponded with Sir William Thiselton-Dyer, mainly about nomenclature of palms, etc., in Egypt.

He contributed the first paper in the Alexandria Horticultural Society's Bulletin no. 1, (1904) pp. 1–13, on "The Royal Horticultural Society."

Bulletin no. 4, (1909) pp. 1–16, contains an interesting article from his pen on the "Wild Flowers around Alexandria," and a portrait of the Admiral forms the frontispiece to this bulletin.

He wrote the introduction to W. Draper's Gardening in Egypt (1895), in which he gave a short history of gardening from the earliest times. His literary talents and keen interest in historical research is reflected in his contributions to Botany and Horticulture.

George Ralph Pierez.—We record with regret the death of Mr. G. R. Pierez, Assistant Superintendent of Agriculture, Nigeria. Mr. Pierez died of pneumonia at Bathurst, W. Africa, while on his way home to England on leave.

Mr. Pierez was appointed Assistant Superintendent in 1919 (*see K. B.*, 1019, p. 447), and had completed his first tour in the Colony. He had been in charge of the Calabar Botanic Gardens, where I spent a pleasant day in his company at the end of February. His death is a sad loss to the Department as he had just acquired the knowledge of Nigerian Agricultural affairs which he would have been able to develope fully for the advance of Agriculture in Nigeria. A. W. H.

Edgar W. Foster.—We record with regret the death of Mr. E. W. Foster, at the age of 42, at Netherne, Surrey, on June 23rd. Mr. Foster was appointed from Kew in 1901 as Curator of the Botanic Station, Lagos, and in 1906 was promoted to be Assistant Conservator of Forests, Nigeria (*K. B.*, 1906, p. 48), and afterwards he became Senior Conservator of Forests, Northern Provinces, Nigeria.

He was invalided home in June, 1919, and later was invalided on pension out of the Service.

George Badderly.—We record with deep regret the death of Mr. George Badderly who for 39 years was preparer in the Museums. Mr. Badderly retired in May 1919 (*K. B.*, 1919, p. 315). He died at the house of his son on July 6th in his 84th year, and was buried at Teddington Cemetery on July 9th 1921, the Director and other members of the Kew Staff being present at the funeral.

Professor Adolf Engler.—We are informed that Herr Professor Dr. A. Engler, Fr.M.L.S., LL.D. (Cantab.), etc. who for over thirty one years has been Director of the Botanic Gardens and Museums, Dahlem, Berlin, retired from that office on April 1st last. During his Directorship Professor Engler has been a constant and valued correspondent of Kew and by the loan of specimens, etc. has rendered ready and ungrudging assistance to this Institution in connection with the preparation of the Flora of Tropical Africa and other undertakings. Professor Engler has been succeeded in the Directorship by Dr. L. Diels, who has for many years filled the post of Assistant Director at Dahlem and is well known to British Botanists from his work on the flora of Western Australia.

Mr. Eugene Campbell.—We learn that Mr. E. J. F. Campbell who has been Curator of the Botanic Station, Belize, British Honduras, since 1896 (*K. B.*, 1896, p. 217), has retired on pension having reached the age limit after 24 years of valuable service in the Colony.

The Emir of Katsina.—The Emir paid a long visit to Kew on Monday, July 11th, and was conducted around the Gardens by the Assistant-Director. He was keenly interested in the collections, both in the open and in the plant houses and also in No. 1 Museum. In the Museum a small exhibition of Northern Nigerian products had been arranged and also specimens of plants likely to succeed in his province were carefully examined. Throughout his visit the Emir displayed a very intelligent appreciation of all he saw and evidently is possessed of considerable knowledge of the plants of Northern Nigeria and their economic possibilities.

He was accompanied by Mr. W. F. Gowers, C.M.G., Lieut.-Governor, Northern Provinces, and Mr. G. W. Webster, Resident Commissioner, Sokoto. His son, two members of his suite, and his scribe, who took full notes of all that was shown them, were also members of the party.

Gift of Drawings of South African Flowers.—An interesting addition has been made to the collections of the Royal Botanic Gardens, Kew, by the presentation by Major Sir Bartle C. Frere, Bt., D.S.O., of a series of drawings of flowers characteristic of the Western Province of the Cape of Good Hope, made by his sister, Miss Catherine Frances Frere, between the years 1877–1880, when her father, Sir Bartle Frere, G.C.B., G.C.S.I., was Governor. There are 34 pictures, many of them given up to single subjects, but on several sheets more than one species is represented. The subjects include amongst others, species of *Gladiolus Babiana*, *Ixia*, *Erica*, *Berkheya*, *Phylica*, and *Protea*. The pictures of the latter genus are particularly interesting for they remind us of a very striking group of plants, almost lost to present day cultivation, which, a centruy ago, was exceedingly popular in greenhouses in the British Isles. Species of *Protea* represented by the drawings are *P. mellifera*, *P. pulchella*, *P. leucosperma*, *P. penicillata*, and *P. speciosa*. The drawings are mounted in oak frames and have been arranged temporarily on the walls of a room on the first floor of Museum IV.

National Botanic Gardens, Union of South Africa.—The Director's report on the Botanic Garden at Kirstenbosch, near Cape Town, for the year 1920 has now been issued. A balance sheet that shows the salaries of the principal officials, *i.e.*, Curator, Ranger, Secretary, Lady Gardeners and Gardeners, to be no more than 845*l.* 19*s.* 0*d*, is apparently a record of services rendered at considerable personal sacrifice, and is an indication of a persevering struggle to make ends meet. Considering, too, the high rates of pay in South Africa, the wages bill for 1429*l.* 3*s.* 7*d.* seems totally inadequate for so large and important a botanic garden. We learn too from the report that *Buchu* has had to be grown in the gardens on a commercial scale in order to provide funds. With such inadequate financial support it is perhaps unnecessary to state that scientific investigations of the plants and plant products of the Union have been impossible during the year under review.

In 1919 Professor R. H. Compton, the Director, issued a memorandum appealing for more financial support, and the annual Government grant, which had been reduced during the war, has happily now been restored. But this amounts only to 1500*l.* and seems barely sufficient for the remuneration, at even a very low rate, of the Curator and the skilled assistance required in the gardens. Professor Compton states that at least a capital sum of 15,000*l.*, and an annual income of about

5000*l*., is necessary to carry out the objects for which the gardens were established. We earnestly hope that Professor Compton's requirements will be fully met when the Government Commission on the lay-out, development and functions of the Gardens has considered the matter.

It is pleasing to note that the offer of the later Mr. J. D. Logan of a piece of land near Matjesfontein for the establishment of a garden of Karroo plants under Karroo conditions has been confirmed by his heirs. J. H.

The Marine Algae of the Danish West Indies.—The interest of the Danes in the study of natural history, not only in that of their own country, but of the distant parts of their kingdom, is strikingly shown in the remarkable series of memoirs on the Botany of the Faeroe Islands and the Botany of Iceland. The same spirit is apparent in the various publications by Dr. F. Børgensen on the marine algae of the Danish West Indies. His largest work on the algal flora of these Islands,* the final part of which has now been issued, is by far the most elaborate of any which has been published on the West Indian marine algae of any region and is based on extensive collections made by Dr. Børgensen during successive visits to the islands. This work, which contains the descriptions of many new species and innumerable critical notes, is marked throughout with extreme care and thoroughness. A special feature is the very large number of illustrations.

Although the islands in question have now passed to America (the Danish flag, after waving for over 250 years, being lowered in 1917), "The Marine Algae of the Danish West Indies" will for all time be found a standard treatise for students of the marine flora of the entire region. A. D. C.

Flora of the Upper Gangetic Plain. After the lapse of five years we are glad to welcome another part of Mr. Duthie's Flora. The families from *Coniferae* to *Juncaceae* are dealt with in 114 pages, full English descriptions being given of each plant treated of and artificial keys where necessary to the genera and species. Nearly half of this part is devoted to the *Orchidaceae*, of which 59 species occur in the area. Other important contributions are the account of the Agaves arranged according to the paper by Drummond and Prain (Agricultural Ledger, xiii. 78) and of the Dioscoreas based on Prain and Burkill's Synopsis (Journ. As. Soc. Beng. N.S. x. 5).

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* The Marine Algae of the Danish West Indies. By F. Børgensen. Bianco Luno, Copenhagen, 1913–1920.
Part I. Chlorophyceae, pp. 158, figs. 126, map 1. 1915.
Part II. Phaeophyceae, pp. 222, figs. 170. 1914.
Vol. II. Rhodophyceae, pp. 498, figs. 435. 1915–1920.

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Plate I.

FIG. 1.

FIG. 2.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 6] [1921

XXVIII.—A VISIT TO THE CAMEROONS AND NIGERIA.

ARTHUR W. HILL.

By the desire of the Rt. Hon. the Secretary of State for the Colonies (Viscount Milner) acting on the request of His Excellency Sir Hugh Clifford, G.C.M.G., Governor of Nigeria, I was enabled, with the permission of the Minister of Agriculture and Fisheries, to visit the Cameroons and Nigeria in February and March last.

The main object of my deputation was to visit and report upon the Botanic Gardens established at Victoria, Cameroons, and to advise the Government of Nigeria as to whether they should be maintained as a Botanic Garden, and if so as to the steps that should be taken for their restoration and future maintenance.*

I left England for this purpose on January 19th and proceeded direct to the Cameroons where I arrived in the evening of February 11th. On February 24th I left the Cameroons, after a tour of remarkable interest, and landed at Calabar the following day, having spent the previous night at Rio del Rey on the border of the two regions.

His Excellency having arranged that I should also see as much as possible of the work of the Agricultural Department in Nigeria, I spent two days in Calabar and made a careful examination of the Botanic Garden with the late Mr. G. R. Pierez, Assistant Superintendent of Agriculture in charge of the Station, before continuing my journey to Lagos.

Owing to an unfortunate misunderstanding of telegrams, it appeared impossible to travel overland via Onitsha and Benin City to Ibadan, so I made my way from Calabar to Itu by launch up the Cross River, thence by car through Ikot Ekpene to Aba and from there by train to Port Harcourt.

From Port Harcourt I travelled by the collier "Diana" to Lagos, where I was met by Mr. Kirby, Acting Director of Agriculture, Southern Provinces, and went by car the same day to Agege, where we spent two nights and inspected the plantation

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* Nigerian Council, address by the Governor, Dec. 29th, 1920, pp. 185, 186.

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and several cocoa farms in the neighbourhood. We then went by train to Ibadan, the headquarters of the Agricultural Department, Southern Provinces, Nigeria, where I stayed some ten days before proceeding to Northern Nigeria and the Bauchi Plateau.

The Victoria Gardens.

The site chosen for the Botanic Gardens could hardly have been more appropriate both as regards natural beauty and with reference to soil conditions and the general character of the ground, which includes both flat land by the river side and a good deal of hilly ground.

The Garden area is situated between the township of Victoria and the village of Bota, lying about a mile and a half apart on the shore of Ambas bay.

To the north rises the magnificent Cameroon mountain from whose slopes comes the Limbe river which traverses the Garden, tumbling over boulders like some mountain stream in N. Wales, and flows into the bay at the Victoria or southern end of the Garden. (Plate I., fig. 2).

Even had the site not been transformed into a Garden, its natural beauty would have been remarkable, bounded as it is by the sea on the western side, rising to a considerable elevation towards the north with a precipitous cliff on the seaward side and traversed by the broad stream falling in rapids and cascades towards the sea. Looking up the valley of the Limbe, the mass of the Cameroon mountain forms an imposing background, the view being flanked by low hills covered with Palms and Tropical vegetation.

As soon as I had set foot in the Gardens, it would, I felt, be a lasting discredit—as His Excellency so forcibly says in his address to the Nigerian Council*—if the Nigerian Government "were to neglect to repair the damage which the war has already unhappily inflicted upon these lovely and valuable Gardens."

The damage caused by the years of comparative neglect since the Gardens came under British control is fortunately not so serious as might be expected, and I was glad to be able to report that no large expenditure either of time or money would be needed to restore them to a state of proper order and efficiency.

The area of the Gardens is about 200 acres, but should an outlying area to the East, which has been cut off from the latest map as here reproduced—the exact boundary of which is not precisely defined, be included in the restored garden, its area would probably be a good deal larger.

The Botanic Garden proper, which lies between the river and the sea, has been laid out with considerable skill and in its landscape effect leaves little to be desired. Owing to the neglect

* Nigerian Council, address by the Governor, pp. 185, 186.

of the past few years certain trees have grown too large and prevented others of greater interest from developing properly, while near the river certain trees and shrubs will have to be removed in order to obtain the full value of the river, but these are matters of detail which need not be elaborated here.

As in other Tropical Botanic Gardens, the trees and shrubs are mainly exotic species. Many of them are of considerable economic value and others are of more purely scientific or æsthetic interest. It was disappointing to find that the native Cameroons vegetation was almost unrepresented, and the same remark applies, as regards the Nigerian flora, to the Gardens at Calabar and to Moor Plantation, Ibadan.

Several varieties of the Oil Palm (*Elaeis guineensis*), including the Lissombe were very rightly to be found under cultivation at Victoria, but many native plants of great beauty and possible economic value were unrepresented.

In the Garden proper certain areas were devoted to examples of such plants as Cacao, *Hevea brasiliensis*, Oil Palms, *Citrus*, Mangos, Nutmegs, Teak trees, *Haematoxylon*, Cedrelas, *Michelia Champaca*,* and other economic trees and shrubs.

To the East of the river large plots were occupied with plantations of Pine apples in variety,† Cacao, *Funtumia*, *Ficus*, *Hevea*, *Raphia*, *Kola*, Teak, Coffees, Bananas, Oranges, &c., which are indicated generally in the map.

To the West of the river there is a good collection of exotic Palms and some magnificent Cycads, and all the more important paths are planted with avenues of introduced trees or Palms such as *Michelia Champaca*, *Calophyllum inophyllum*, *Terminalia Catappa*, *Martenezia*, *Areca*, *&c.*

The Garden is well furnished with useful buildings in which research work and the teaching of agricultural pupils was carried on. The buildings located in different parts of the Garden, which are numbered in the map, are—

(1) *The Agricultural School*—now the Garden office—consisting of two rooms below where instruction was given to the first and second year pupils, and rooms above where the boys were housed. These upper rooms are now occupied by the Garden's Foreman.

(2) *A small Cacao-drying shed* used for Demonstration purposes close to the school buildings.

(3) *The Herbarium and Museum* consisting of three good rooms with living rooms above. The contents of the Herbarium have been removed, though a few of the tin cases contain sheets of plants, badly eaten by insects, and a few specimens of little value still remain in the Museum cases.

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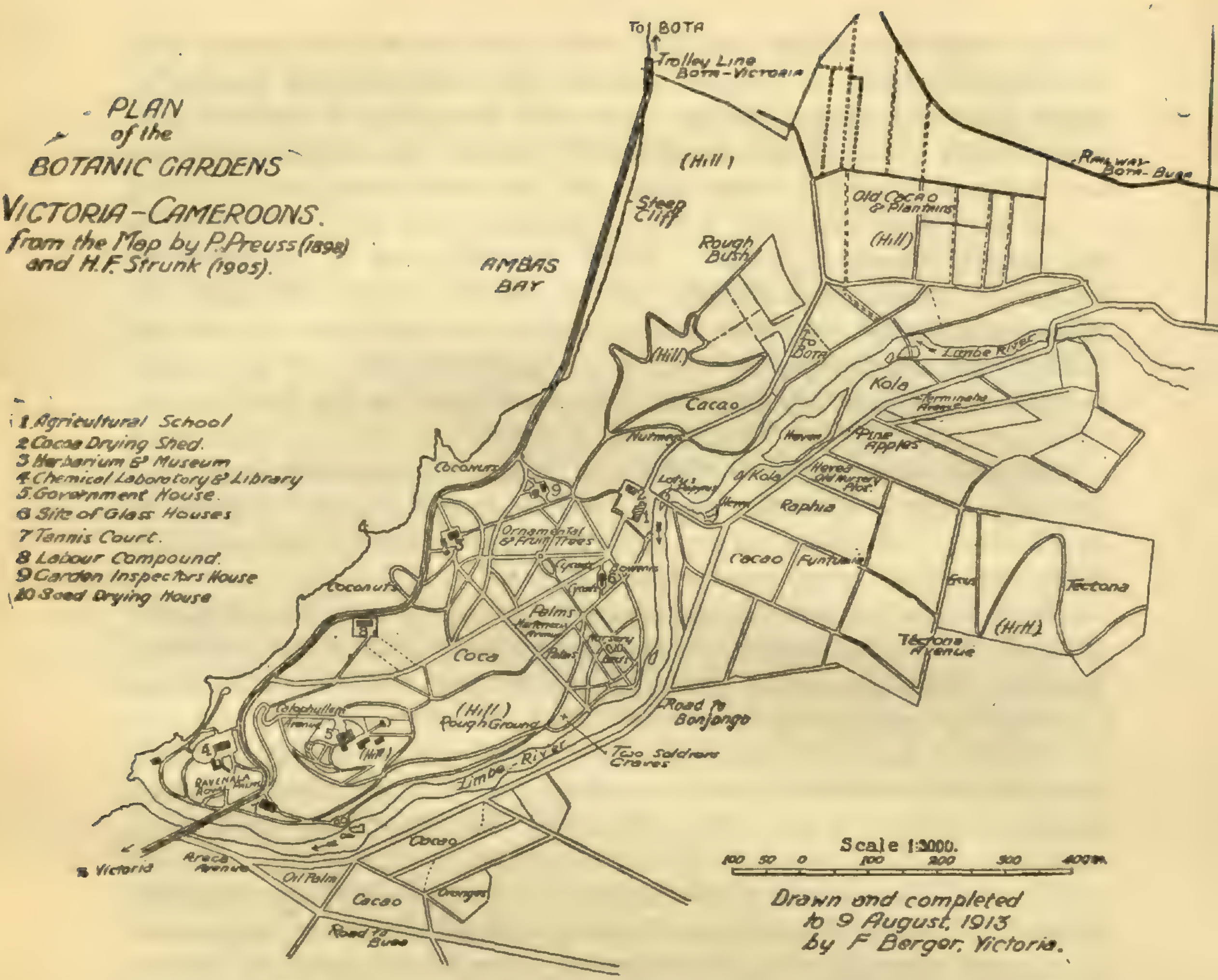
* *See* Deistel, H. "Tropischer Gartenbau," Deutsche Tropen-Bibliothek Bd. 1. Hamburg. Plate facing p. 20.

† Deistel l.c. Plate facing p. 16. All the Plates in this work are from photographs taken in the Victoria Gardens.



The removal of the specimens to a place of safety has no doubt ensured their preservation, but their proper home is at Victoria, and it is essential that they be returned there when the Gardens are placed under scientific management.

(4) *The Chemical Laboratory and Library*, well stocked with chemicals and containing a quantity of apparatus of considerable value. The rooms are fitted with benches, etc., and the book cases are filled with a very good collection of scientific books.

The upper portion of this building is a good house, and the whole building is now in the occupation of the medical officer.

(5) *Government House*, which is only occupied when the Resident comes down to Victoria from Buea. This stands on the summit of the steep hill at the Victoria end of the Garden, and the views over the Garden and Victoria, or away inland towards the mountain, or in the seaward direction are magnificent.

The other sites marked on the map are :—

(6) The site of two greenhouses where orchids were grown, the glass and framework of which were removed to Buea.

Plate II.

FIG. 4.

FIG. 3.

(7) a tennis court,

(8) a small and very unsightly block of native huts, near the sea, erected by the late owners for the Garden labourers, which should be removed if the Garden is restored as at present they are a great eyesore.

(9) There is also the Garden Inspector's house, No. 9 on the map, and a small seed-drying house (10).

The buildings, as may be supposed, have suffered a good deal from neglect, but, as they are well built, it should not prove very costly to restore them to their former condition and make them valuable Laboratories and Offices and a School for carrying out the research and educational work of the Gardens.

In connection with the Garden at Victoria some experimental plots had been made at Buea at elevations of 3400 ft. and upwards on the slopes of the Cameroon mountain. These now come under the manager of the Government Farms at Buea and it was here that experiments were made and are still continued, in the growing of every kind of vegetable cultivated in European gardens. The stock farm for cattle and pigs is also situated at Buea.

Experimental plots of Tea and Cinchona had been made at Buea, and these though very neglected and now considerably choked with rough grass and bushes prove that both these economic plants are amenable to the conditions at 3400–3600 ft. on the slopes of the mountain. The Tea plants are in two plantations and the bushes of a somewhat pyramidal shape are now some 10–15 ft. high, many of them being in flower and fruit at the end of February. The Cinchonas are slender trees, densely smothered at the base with rank growth and are some 20 ft. high and evidently of several varietal forms, hybrids apparently of *C. succirubra* and *C. Ledgeriana*.* Neglected as they are, they have grown fairly well, and it seems evident that the cultivation of Cinchona might be a practical proposition. (Plate II., figs. 3 and 4.)

At Buea or at some other mountain station it should be possible to grow Potatoes successfully and produce a supply which would be of great value both to the Cameroons and Nigeria. It might be found possible with careful selection to grow a strain of potatoes without the necessity of getting out fresh 'seed' from home, but experiments, which should certainly be undertaken, will be needed in order to see how far this may be possible.

It also appears probable that at higher elevations—5000 to 6000 feet—in the Bimenda region the experimental cultivation of wheat might be undertaken. It would also be desirable to establish a low country station in connection with the cultiva-

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* *See* Deistel, Government Gardener, Tropenpflanzer Oct. 1905, No. 10, where particulars of the sources of these plants are given.

tion of the Sugar Cane and the Banana for which there is a large tract of low lying ground available on the N. side of the Duala creeks.

The Plantations.

The Plantations are the striking feature of the British sphere of the Cameroons near the coast, stretching round the base of the mountain from near Rio del Rey to Missellele and beyond.

They occupy a belt of country from sea level to about 1800 ft., only interrupted here and there by small native reserves. These plantations were the property of individuals or companies and excellent houses, drying sheds, sawmills and other offices are to be found at each centre.

Thanks to the admirable arrangements made by the Supervisor of Plantations, Mr. F. Evans, Superintendent of Agriculture, Nigeria, I was able to visit most of the principal plantations, and my tour was all the more easy owing to the convenient system of trolley lines, both double and mono-rail which exist throughout the plantations. Where trolley lines did not exist our journeys were made on horseback.

In these ways the plantations of Victoria Fárms, Ekona, Moliwe, Tiko, Molyko, Debundscha and Bibundi, were visited.

It may be of interest to give a few particulars of some of these plantations :—

The Victoria farms have an area of about 42,000 acres, of which some 3300 acres are under cultivation principally with Cocoa. The soil here is rather shallow in parts, the volcanic rock being near the surface. The Cocoa on this estate showed a good deal of ' die back ' and was in a less satisfactory condition than in other plantations.

Ekona has an area of about 14,000 acres, some 2843 being under cultivation with Cocoa, Hevea and Funtumia Rubber, Kola and Oil Palm. The plantation is at about 1200 ft. on the Eastern side of the Cameroon mountain and the condition of the Cocoa and Kola was very good. The soil is rich and deep. At Ekona there are excellent Cocoa drying sheds and saw mills run by electric power, &c. Here as elsewhere the Cocoa has been interplanted with Oil Palm and Rubber Trees, and the mixture, especially with the Oil Palm, is far from satisfactory. (Plate I., fig. 2.)

Moliwe, on the S.E. slopes of the mountain, is at about 1500 ft. elevation and is said to be some 37,000 acres in extent, 4465 being under cultivation in Cocoa, Rubber, Kola and Oil Palm. From the Plantation Manager's house, situated at the top of a conical hill some 500 ft. above the general level, the views over the country towards Duala on the one side and the mountain on the other are very striking.

The Tiko & Woermann Estates are mainly on the level ground by the creeks of the Mungo river and are reputed to have an area of 30,150 acres, of which 2600 are said to have been planted.

Bananas and Plantains are the principal crop and the main outlet was by water from the Tiko wharf. It was from the pier, made of cast iron piles, 115 metres long, that the s.s. "Moewe" used to set out loaded with Bananas for Hamburg. Here also there is a Banana-drying shed and a saw mill.

At *Missellele*, which I was unable to visit, Coffee is one of the principal crops.

The *Molyko* concession on the S. slopes of the mountain is some 42,000 acres in extent, about 3000 being under cultivation. Its elevation is from 1500–1800 ft. and Cocoa is the principal crop.

Debundscha and *Bibundi* lie on the W. slopes of the mountain and are mainly at low elevations. *Debundscha* is noted for its excessive rainfall, as much as from 550–600 inches in the year having been recorded. *Bibundi*, lying beyond to the North, also enjoys a heavy rainfall. Here a rotary Cocoa dryer had been installed and the saw mills and plantation offices generally were on an elaborate scale. An avenue of Avocado pears some 3 miles long had also been made through the plantation, which is mainly Cocoa, and the trees laden with ripe fruits were in excellent condition.

From this brief account of these extensive plantations it will be seen that they are likely to provide pathological and other problems needing scientific investigation and research, far more than is the case in Nigeria proper, where plantations are on a relatively small scale.

It is to be hoped that with the restoration of the Victoria Gardens, it may be found possible to establish there a department of plant pathology, so that expert scientific advice will be available and investigations may be undertaken upon the various diseases from which large plantations are liable to suffer, and combative remedies may be suggested.

The necessary laboratories, where work of this kind can be carried out, are already in existence, and the past history of disease in large plantations may be cited in evidence of the urgent need of scientific investigation and control under artificial plantation conditions. Not only is there the constant menace of disease when large areas in the Tropics are devoted to the cultivation of one particular economic product such as Cacao, Hevea rubber, Coffee, &c., but there are other fields of research which it is most desirable to explore.

Of paramount importance, as has recently been demonstrated in Malaya, is the finding of the most economically useful varieties for cultivation. This may be done either by selection or by breeding or by a combination of both methods, and entails accurate scientific knowledge and usually much patient research. On work of this kind, however, depends very largely the commercial success of some particular economic product grown either as a crop or under plantation conditions, and the useful work that has been done in the Northern Provinces, Nigeria, in

selecting Cotton for length of staple may be adduced in evidence of the value of such work.

Soil questions also open up a wide field of research, as it is not uncommon to find that plantations or some portions of them have been made where the soil is not suitable for a particular plant and disease manifests itself because of such unfavourable conditions. The primary cause of the trouble being bad conditions and not the fungus or insect pest which is the obvious result.

In addition to research, instruction should also be an important function of a Tropical Botanic Garden, for intelligent labour both in the Garden itself and in the plantations is essential to success and progress.

In no place can such instruction be better given than in a Botanic Garden, especially to boys and young men, since they can become acquainted with all the important economic plants and acquire a sound practical knowledge of their culture and methods of propagation in the course of their ordinary duties, and on this can be built up a theoretical knowledge by means of lectures and demonstrations.

A properly equipped Botanic Garden can thus play a very important and most essential part in a colony whose welfare depends largely on the success of plantation enterprises, and it is to be hoped that the Victoria Gardens will fill this rôle when they have been restored and are maintained in a state of efficiency.

Nigeria.

Nigeria offers many striking contrasts to the British sphere of the Cameroons, both as regards its physical features and the methods of cultivation employed. In the Cameroons the soil is for the most part fertile and consists of decomposed volcanic rock with an abundant water supply.

In Nigeria, the soil is mainly laterite with granitic rocks in the Northern Territories, and not only is the water supply very poor, but in the Northern territories there is a dry season of some 6–7 months which seriously hampers agricultural operations.

In Nigeria too the land is mainly in native hands and the native plots under cultivation with such introduced products as Cacao, Rubber, American Cotton, &c., are relatively small and separated from one another by broad belts of bush.

Fungoid diseases, therefore, though often present owing to faulty planting or to unsuitable conditions, are not able to spread far and wide, as they can under an extensive plantation system and remedies when suggested are as a rule not adopted owing to the ignorance or indifference of the native cultivators.

Such conditions thus minimise to some extent the need of skilled scientific workers, though they may still find much to do in investigating the causes of disease. Any control work that may be needed should come well within the competence of the itinerant agricultural officers.

Botanic Gardens and Plantations.

The oldest surviving Botanic Garden or Botanic Station in Nigeria is that at Calabar. This is well situated and planted with a useful collection of exotic economic products, which are much the same as those at Victoria. The natural beauty of the site and the soil, however, are not to be compared with the Cameroons Garden.

In the experimental grounds attached to the Garden are examples of all the useful Tropical products suitable for cultivation in the province, and from the plants grown it may be seen what could be cultivated with profit to the community. As an instance the Sugar Cane may be cited. This is growing well and it seemed likely that much ground near Calabar might be put under sugar cultivation. The necessary enterprise, however, seems to be lacking and instead of growing and making sugar around Calabar the whole of the sugar consumed in the Colony is imported into the country.

A small and practically useless sugar plant has been set up in the station, but it seems hardly the function of the Agricultural Department to demonstrate that sugar can be made from Sugar Cane, but rather that it is possible to grow the raw material.

There is a tendency with Botanic Gardens in the Tropics, noticeable to some extent in Nigeria, to regard them as places where fruit and vegetables should be grown for the benefit of the white community. That they should serve as instructional centres for disseminating knowledge about the possibilities of growing such useful products is legitimate, but the cultivation of such products on a commercial scale, as also in the case of sugar, should be entrusted to private enterprise. Such private enterprise, however, should be stimulated and encouraged as far as possible by the Agricultural authorities. In the Federated Malay States market gardening enterprise has been successfully undertaken by the Chinese, and it would seem possible, from what one saw in N. Nigeria, gradually to encourage the W. African native to take up the growing of vegetables for market, as a commercial venture.

The Botanic Stations should also be prepared to propagate and distribute the most suitable varieties of economic plants for cultivation, and this function was being well performed by the Gardens and Plantations in Nigeria.

The other Stations and Plantations visited were those at Agege, near Lagos; Ibadan, the headquarters of the Agricultural Department, Southern Provinces; Kaduna, the headquarters for the Northern Provinces and the experimental station at Maigana near Zaria.

The time at my disposal unfortunately did not allow of a visit being paid to Onitsha or to Ilorin, where useful work has been done in the selection of Tobacco and Cotton suitable for cultivation in that district.

Southern Provinces.

At Agege, *Cacao*, *Hevea* and *Kola* were being grown, and there is a small Cocoa-drying and fermenting plant as well as a rubber shed. The plantation, though small, ought to serve a useful purpose as a Demonstration Centre, but owing to the small staff of the Agricultural Department it can only be visited at rare intervals by an official, and the work has to be left in charge of a native overseer.

It was clear from what could be seen at Agege and at Ibadan that the cultivation of *Hevea brasiliensis* by small holders is not likely to prove a financial success. The tree grows well and appears to be free from serious fungus disease, but it is eminently a product for growing under plantation conditions. Unless therefore a system of co-operation among neighbouring small holders owning fairly large areas of Hevea can be established, the cultivation of this tree by small native landowners appears to be a wasteful diversion of their proper agricultural activities.

The prevalence of the Oil Palm is the remarkable feature in the landscape throughout the greater part of Southern Nigeria; here and there a few *Raphia* and *Borassus* Palms can be seen, but with these exceptions the great belts of pure Oil Palm dominate the scenery.

It was obvious that it would be futile to attempt to replace the vast numbers of indigenous Oil Palms by any better-yielding varieties which might be raised at an Experimental Station, however desirable it may be to produce a strain yielding a higher percentage and a better type of pericarp and kernel oil.

Moor Plantation at Ibadan, where the headquarters and Laboratories of the Agricultural Department (Southern Provinces) and the residences of the principal officers are situated, is a far more ambitious undertaking and one from which the Colony should derive a great amount of benefit. Whether it has fully fulfilled its functions in the past may be open to question, but that it should be able to play a very important rôle in the development and progress of Nigerian Agriculture in the future cannot be doubted.

Here experiments have been conducted on the cultivation of Coconuts, Ceara Rubber, *Cacao*, Oil Palms, Abeokuta Coffee, *Kola*, Teak, Mahogany, *Cedrela*, native *Phaseolus* for green manuring, &c.; while in a large orchard plot Citrus trees in variety, Bananas, Pineapples and various Tropical fruit trees are under cultivation, which serve as a useful demonstration of the edible fruit trees likely to succeed in Southern Nigeria. The nurseries for the propagation of useful economic and ornamental plants are well arranged and well stocked with good young plants for distribution. Experiments were also in progress in fallowing the ground, green manuring, etc., which should lead to useful results.

In two directions, however, it seemed that there was a great and pressing need for investigation and research, and the same remarks apply both to the Northern and to the Southern Territories. In the first place, very little, if anything, is known about the bacterial flora of the soil and of the effect on the soil of the burning tropical sun and the long dry season. Further, the universal native practice is to burn down the grass and bushes covering the ground before any attempt is made to till the soil. What effect has this annual burning on the soil and its organisms? Is it harmful or beneficial? It may be that noxious insects and fungi are killed in the process. But may there not at the same time be a loss of valuable chemical substances from the soil owing to the roasting of the ground by the fierce heat of these bush fires?

Then, too, the peculiar native methods of cultivation, primitive as no doubt they are, may and probably have underlying them some scientific principles of value, though they have been developed empirically by the natives as the result of long years of experience.

Such conditions and our lack of definite knowledge suggest the urgent need of appointing Agricultural Chemists, well versed in the science of soil biology, to discover what underlying principles there may be in native practices and also, if they are found to be of value, to develope them and gradually to improve the methods of cultivation suitable to the country.

The need of Agricultural Chemists has been fully realised by His Excellency the Governor in his despatches and in his Address to the Nigerian Council (p. 182), and it is to be hoped that this much-needed line of enquiry will soon be undertaken.

The other direction in which there is an extensive field for useful investigation is that embraced in the term Economic Botany in its widest sense. Very little, it appeared, is known of the plants used by the natives for food and for other purposes, reliance being placed by the European officials on products with which they are familiar at home. Thus many native plants, which would be of undoubted service to the white community as edible vegetables or for other purposes, are disregarded and opportunities of promoting the health both of the white and native population are sadly neglected. Many of these native plants would doubtless be found susceptible to improvement by selection or hybridisation, and I am convinced that a far-reaching benefit would be conferred were Economic Botanists appointed in the Agricultural Department, whose prime duty it would be to investigate as fully as possible the native economic products and demonstrate their value for the good of the community.

Up to the present the activities of the Agricultural Department have largely been centred in the introduction of exotic plants of economic importance to the neglect of the study of

native plants likely to be useful for food, green manuring and the like. It is to be hoped therefore that this state of affairs will soon be remedied and a careful survey of the native flora will be initiated by competent Economic Botanists.

At Ibadan, agricultural instruction has been given to a certain number of native youths, but I doubt if the scheme has been given a proper chance of success. In order to inculcate an interest in the sciences of Horticulture and Agriculture, training should begin in the Elementary Schools. With a community like that of Nigeria, where Agriculture is the dominant industry, the training of the children in the elements of Horticulture and Agriculture should be commenced by means of properly organised school gardens.

The syllabus of Agricultural Training in the Education Code of Nigeria provides for the instruction of children by the growing of such exotic plants as Para Rubber, Cocoa and Coffee, and neglects those native plants, familiar to the children, which are of economic value. At present, therefore, it seemed that very little good was being done in this direction and that there was a great need for better methods.

It should be arranged for the school gardens, in which *annual* native and exotic plants ought to be grown, to be inspected regularly by officers of the Agricultural Department. The teachers should also be given lectures at the Agricultural Experimental Stations, and an early interest should thus be promoted and a real education given in a subject on which the prosperity of the country so largely depends.

After this preliminary introduction it would be possible to select a certain number of the more intelligent pupils and train them further at the Experimental Stations. In due course such scientifically trained boys should become competent farmers and agricultural inspectors and so serve to disseminate better farming methods throughout the country.

The proper training of such boys necessitates the appointment of well-equipped permanent Curators of the Stations, who should be competent not only to supervise the accurate conduct of the scientific experiments, but also to impart instruction to the pupils.

The formation of local Agricultural Societies is another method of interesting the native farmers in the scientific principles underlying agricultural practice, and also of enabling the Agricultural Department to get in touch with and gain the confidence of the farmers.

I was impressed very forcibly by the fact that there was much to be learnt from a careful study of native farming methods, both in the Northern and in the Southern Territories, and that the surest way of discovering what may be of value and of inducing the natives to adopt improved methods is to gain their confidence and impress on them that it is only by their co-operation and help that agricultural progress can be achieved.

Northern Provinces.

The activities of the Agricultural Department in the Northern Provinces have been fruitful in several directions. In the first place the Kaduna roadsides have been planted with flowering trees, which even now are forming avenues of considerable interest and beauty. Secondly, it has stimulated vegetable and flower gardening, etc., and as a result the Kaduna Horticultural Society is a flourishing association of keen gardeners, while at the Ilorin and Maigana Plantations useful work is being carried out on the selection of Cotton, Maize, Ground Nuts, Guinea Corn, Tobacco and other Economic Products. A brief account of the tree planting at Kaduna and of the Botanic Station has been given in the Annual Reports of the Department for 1914 and 1915 (see *Kew Bull.* 1917, p. 30). The site of the Station on the bank of the Kaduna river is a beautiful one, but it is at present a purely economic garden and is not laid out as an ornamental pleasaunce. Nor is it near enough to the town of Kaduna to make this very desirable.

There is a very good collection of useful fruit trees, and vegetables of all kinds are being grown there with great success. In the dry season such cultivation is only possible with irrigation, and this is regularly practised. With the river alongside, there is plenty of water, but during the dry season the level of the river is so far below the garden level that the lifting of the water presents considerable difficulty.

Owing to the dryness of the air in the dry season and the heat of the sun, not only vegetables but also pineapples have to be grown under a light shade, and it is also necessary to protect the bunches of Bananas with straw in order that they may ripen properly and not dry up on the plant. It was of interest to learn that potatoes have been successfully cultivated and that, as I was able to see, the tubers will keep well if stored in a shaded pit with wood ashes and covered with dry grass.

The fields at Maigana plantation were naturally all bare and fallow at the time of my visit, but the results of the cotton and other selections were examined in the sheds. It was of interest to see examples of the longer stapled Allen's cotton which have been gradually selected at the Experiment Station, and it is hoped gradually to replace the inferior strains now grown by the native cultivators with the best strains selected at Maigana, and so increase very largely the value of the cotton output for the Northern Provinces.

Vegetable growing, and also the cultivation of onions, sugar-cane and calabashes is practised by the natives in N. Nigeria to a considerable extent, and the onion crop is usually very good; the native method of watering by means of a "shadoof" and then running the water so lifted along channels is very practical and inexpensive and might well be developed to advantage.

With a simple system of lifting the water as used by the

Hausa cultivators, and terracing of the garden ground, it should be possible to irrigate by gravitation considerable tracts of suitable land along the banks of streams and rivers.

It would seem that if this native system of cultivation could be encouraged a large supply of useful vegetables could be raised by market-gardening natives which would be of great benefit to the country.

The Agricultural Department could also assist the market gardening enterprise by assisting with the selection of suitable seeds, and with regard to onions especially, they might help greatly by selecting a strain of non-bolting Nigerian varieties. It was noticed in one native garden that quite 50 per cent. of the onions grown from native seed were running to seed without forming bulbs, and this state of affairs could easily be remedied by scientific assistance.

It is realised, however, that valuable work of this kind will not be possible until the Agricultural Department has its full complement of scientific officers.

The problems to be faced in the cultivation of vegetables and flowers under the arid conditions of N. Nigeria have been very successfully surmounted at Sokoto, where the influence of the neighbouring desert is far more potent than at Zaria or Kaduna.

Dr. Bernard Moiser, Senior medical officer, Sokoto, has achieved a remarkable success under very adverse conditions with his garden at Sokoto, and to my great regret time did not permit of my paying it a visit.

The garden has been well described in the current number of the Journal of the Royal Horticultural Society,* and both the successes and failures are recorded, thus making the account of permanent value. Dr. Moiser has, in effect, established a small Botanic Garden of considerable educational value, which is a veritable oasis in the midst of dry and cheerless surroundings, and it is to be hoped that the Government of Nigeria will be able to arrange for its permament maintenance should the Founder be transferred to some other sphere of activity.

Horticultural enterprise in Nigeria owes a further debt to Dr.Moiser for his pamphlet on Gardening in the Northern Provinces, published by the Kaduna Horticultural Society, which has been of great value to the members of that enterprising and useful body, and has evidently stimulated a keen interest in gardening in Kaduna and the neighbourhood.

It was unfortunate that the time of my visit to Nigeria coincided with the close of the dry season so that it was not possible to see any agricultural operations in active progress.

The fields in the Northern region were all bare and dry and the soil had been hoed into long broad furrows. The cultivation

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* "Pioneer Work in Nigeria: The Sokoto Gardens," by Mrs. R. Lamartine Yates; Journal of the Royal Horticultural Society, Vol. XLVI, May, 1921, pp. 336–345, with Plates.

here is good, and the appearance of the ground suggests spade or even plough work, whereas a back-breaking form of hoe is the sole native tool. This in shape is similar to the tool referred to by Mr. M. T. Dawe in his recently published report on agricultural conditions in the Gambia*.

It is possible that in some parts where the land is open, and there are no "Doka" and other bushes, that a plough might be used with advantage, as Mr. Dawe suggests for parts of the Gambia, but the native is so proficient with his hoe, and has so little knowledge as yet of other implements, that little good can be expected for some years from the introduction of either animal-drawn or motor ploughs with which he is unfamiliar.

In the Southern Provinces there would appear to be practically no scope for a plough of any kind as the cultivated plots are usually small and widely scattered.

In Northern Nigeria, as I have mentioned, there is no lack of animal manure, and the common practice is to turn the herds of Fulani-owned cattle on to the fallow fields during the dry season at night time. In this way the tilled ground receives a good supply of manure, but as the droppings are exposed to the sun's heat, and no attempt is made to cover the droppings by turning them into the soil, it seems probable that a great deal of their fertilising value must be lost.

Owing to the dry and baked condition of the ground the conservation of the manure is no easy matter and some radical change in tillage methods may be needed in order that the full benefit may be obtained. Should it be found possible to cover and spread the manure by some form of light harrowing, it would probably lead to an increased fertility of the soil. Before any such radical alterations in native procedure can be advocated however, it will be necessary to subject them to careful investigation and experiment at one or more of the experiment stations or plantations.

Another direction in which useful results could not fail to be realised is irrigation, but this naturally is dependent on the availability of water. Wherever possible the native methods of irrigation should be improved and extended, and the ground in the neighbourhood of water should be terraced so that the largest possible area may be brought under irrigation and devoted to the cultivation of vegetable and other food crops.

The Bauchi Plateau.

One of the most interesting parts of my tour in Nigeria was the visit I was able to pay to the Bauchi Plateau. As there were no specimens in the Kew Herbarium from this region I was anxious to pay a visit in order to meet those who might be sufficiently interested in the Flora to make collections for Kew.

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* Report on the agricultural conditions and needs of the Gambia by M. T. Dawe, Crown Agent for the Colonies, 1921, p. 41.

His Excellency the Governor having kindly granted me permission to extend my tour to visit the Plateau, I spent some interesting days around Jos in the company of the Director of Agriculture, N. Provinces, and was very gratified to find several people who were willing to assist us in sending home specimens.

The journey from Zaria to Jos is about 132 miles and the train climbs slowly the 2000 ft., the greater part of the ascent being towards the end of the journey. The time taken was about eleven hours, and, as there is a passenger train only once a week, the journey both up and down was made in one of the large covered luggage vans attached to the daily goods train leaving Zaria at 7.15 a.m.

The scenery throughout the Zaria province is somewhat monotonous; dry savannah or sparse park-like vegetation, the dominant plant being the "Doka" (*Isoberlinia doka*), which, despite the dryness, was coming into fresh leaf everywhere. Other conspicuous trees were *Parkia filicoides* and Shea butter, while the shrubs were mainly *Anona senegalensis*, Combretums and Acacias. (Plate III., fig. 6.)

The ground in many places was studded with the large yellow flowers of *Cochlospermum tinctorium*, Rich. (*Bixaceae*), and the conical red earth ant heaps were a conspicuous feature

Around the villages large areas are devoted to cultivation and here the *Parkia* trees are carefully preserved by the natives, as their leaves are used as green manure.

The effects of the burning of the bush and old grass, to encourage young growth, were much in evidence, and it was remarkable to notice how little the "Doka" and other bushes and trees were injured by the fierce heat of these annual bush fires.

On the plateau the aridity of the country, at the end of the dry season of some seven months, was very striking, so that the number of plants that were in flower or were bursting into fresh green leaf was all the more remarkable. The problem of the water supply is worthy of investigation as the ground appeared to be quite dry though the water table must, it would seem, be fairly near the surface. The bare granitic hills which crop. out around Jos and Naraguta add to the general dry and barren effect of the landscape.

These dry granitic hills are the home of many xerophytic plants of interest, but unfortunately the Cactoid Euphorbias (Plate III., fig. 5), and Asclepiads with their stout grey stems were not in flower. Here also was growing a white-flowered leafless *Senecio* with the habit of a xerophytic Euphorbia, which has proved to be a new species and has been named *S. Cliffordianus*, in honour of His Excellency the Governor.

Other plants found among the dry rocks were a *Sansevieria*, an *Aloe* in seed, living specimens of both of which were brought home to Kew, and *Strophanthus sarmentosus*.

The Pagan villages, consisting of clusters of small round mud houses, are to be found among the rocky hills, and are surrounded,

Plate III.

FIG. 6.

FIG. 5.

[*To face page* 240.

Plate IV.

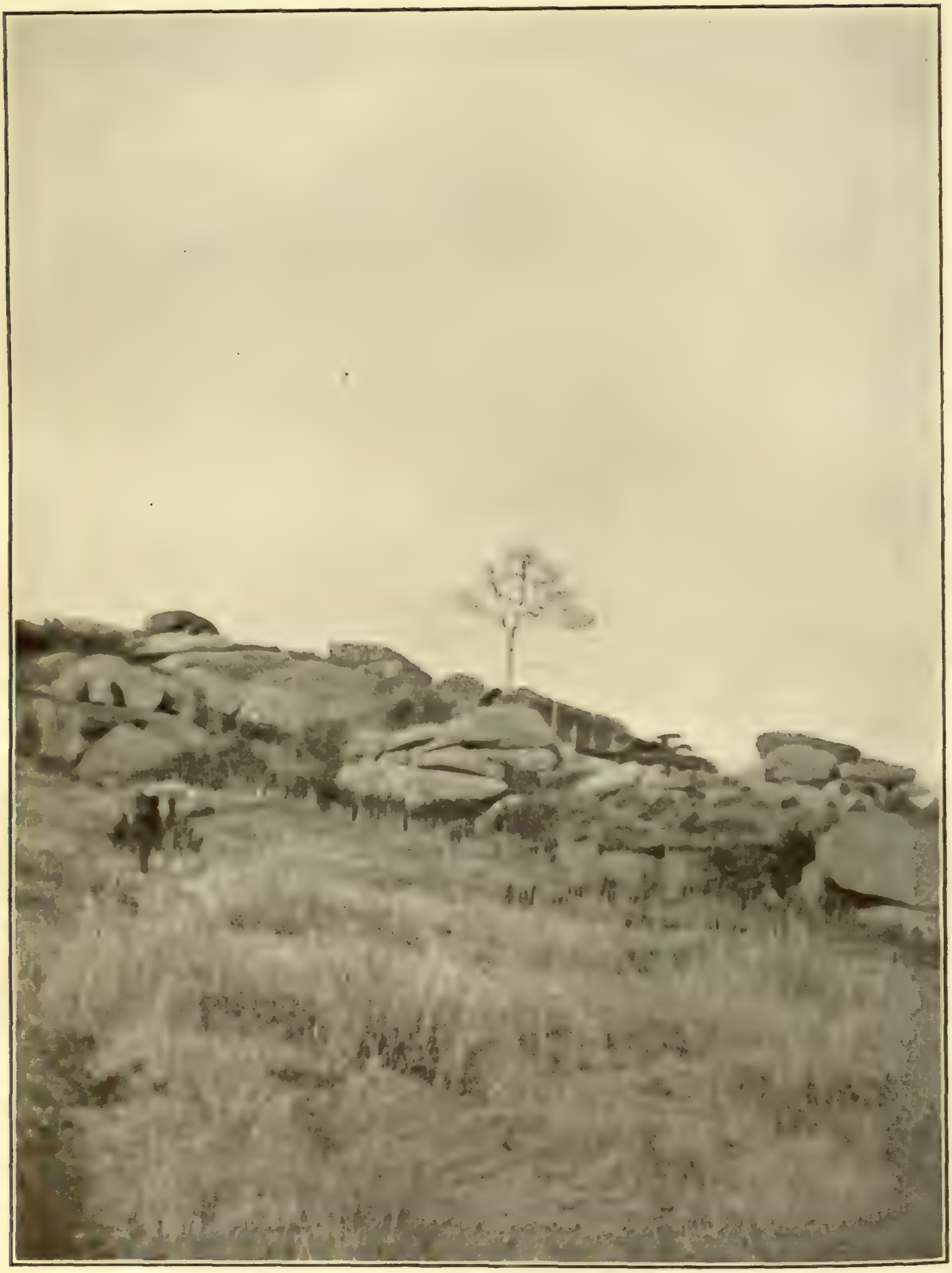

FIG. 7.

To face page 241.]

as are also their small fields, with a close and impenetrable stockade of columnar Euphorbias. (Plate IV., fig. 7.)

Despite the dryness some eight new species of flowering plants were collected, and if this could be done in the course of a three days' visit at the end of the dry season, it is obvious that there must be a considerable number of plants on the plateau of which as yet we have no knowledge.

It is hoped therefore that others may be stimulated to collect, and so add to our knowledge of the Flora of the plateau and of the Northern Provinces generally.*

I had the good fortune to meet several managers of the various mining companies engaged in the Tin-mining Industry, and was pleased to see how keenly interested they were in making beautiful and useful gardens. As might be expected flowers familiar to them at home were their chief concern, but they had often collected native plants, and several interesting species were to be seen flowering in their gardens.

Among these *Mussaenda arcuata*, Poir., in Mr. Bourke's garden at Naraguta, which grows wild near by, promises to be an ornamental plant worthy of cultivation. Equally, or even more beautiful, would be the new species of *Ochna* (*see* p. 241), which I had the good fortune to discover, *Feretia canthioides*, Hiern, *Lonchocarpus seriseus*, H.B.K., and many other indigenous native trees and shrubs of great beauty, which do not as yet appear to have been subjected to cultivation.

A white-flowered *Ochna*, and a few other interesting native plants were being grown in Col. H. W. Laws' charming garden at Tudun-Wada near Jos.

Attempts have naturally been made in the Plateau gardens to grow apples, grapes and strawberries, etc., but unfortunately, owing to the unsuitable nature of the climate, no great measure of success has attended the care and trouble which has been bestowed upon them. A blackberry was growing well and fruiting in Mr. Bourke's garden.

Both on the Plateau and in Nigeria generally it was interesting to find how keen the desire of the majority of the officials and traders was to establish gardens for use and beauty around their homes, and in many cases they were only waiting for advice and instruction to enable them to realise their aspirations. To all such would-be gardeners the pioneer work of Dr. Moiser at Sokoto should give encouragement and hope.

Conclusion.

My visit to the Plateau concluded my tour in Nigeria, and it was with great regret that I had to turn my steps homeward without having been able to see more of the country. Even

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* Since my return, Mr. H. V. Lely, Forest Officer at Naraguta, has sent about 350 excellent dried specimens from the plateau. A few were already represented in my own collection (*see* Article XXIX.), and all are of great interest and value.

as it was, however, I was able to cover a considerable amount of the Protectorate and see something of the different types of country and study the various problems they present. For the interest and value to myself of the whole tour in the Cameroons and Nigeria my thanks are due, in the first place, to His Excellency Sir Hugh Clifford, not only for the welcome he gave me, but more especially for the kind arrangements he made, through the officers of the Government of Nigeria, for the successful accomplishment of my objects.

To the Supervisor of Plantations, Cameroons, Mr. F. Evans; the Acting Director of Agriculture. Southern Provinces, Mr. A. H. Kirby; the Director of Agriculture, Northern Provinces, Mr. P. H. Lamb, and his Superintendent, Mr. K. T. Rae, I am particularly indebted for all the help and assistance they gave me, and for their kindness in making it possible for me to see as much as possible of the country, and learn something of its agricultural possibilities and of the difficulties with which they have to contend.

Nor should I omit to record my indebtedness to the Residents and other political officers with whom it was my good fortune to come in close personal contact. The list of these would be unduly long, but, as in private duty bound, I must mention Captain G. Anderson, Resident, Cameroons, Mr. R. A. Hargrove, Resident, Calabar Province, and Captain W. A. Ross, Resident, Oyo Province, who were at special pains to make my tour of the greatest possible value.

To Captain Ross, whose knowledge of the Yoruba country and sympathy with its peoples has been gained by a long residence in their midst, I am particularly indebted. Thanks to his kindness I was able to see the country from Ibadan to Oyo and Iseyin, and to gain a far more intimate knowledge of the Yorubas, their arts and their industries than would otherwise have been possible. That these people are imbued with a strong artistic feeling and with a high degree of intelligence, which is also the case with the Hausas of the north, was clearly evident.

This is no doubt true also with regard to some other of the native races of Nigeria with whom I was not able to come in contact. As to their artistic qualities the beauty of the native cloths woven and dyed with the native indigo (*Lonchocarpus*), in the Yoruba country, the basket and mat making at Oyo, Iseyin, Bida, etc. the native pottery, made entirely without a potter's wheel, perfectly formed and finished with a singular sense of grace and proportion, may be cited in evidence.

That this is the case augurs well for the future development and progress of the country, especially in matters agricultural, and leads me to repeat what I have said earlier that success in promoting the agricultural prosperity of Nigeria will depend very largely on our appreciation of the fact that their knowledge, based as it is on long years of hard-won experience, is worthy of careful study.

Our duty, as it appears to me, is first to learn whatever there may be of value in native agricultural methods, and then, having estimated their worth, to endeavour to improve upon them with the aid of scientific research, so that they can be recommended for adoption in confident assurance that the native agriculturists will co-operate and apply them.

It is apt to be forgotten that the native races have had insufficient time to adapt themselves to the new conditions introduced with the British administration, or to acquire the knowledge which it has taken the European centuries to assimilate.

We forget possibly, in our endeavours to impart information, how elementary that instruction must be at the start in order that it may be properly grasped and appreciated. In matters agricultural, I feel convinced that for real progress to be ensured, not only must our instruction be given on lines adapted to meet the needs of a primitive community, but it must be begun with the children themselves. This can best be done by means of a carefully thought out system of elementary education, based very largely on the principles and practice of gardening and horticulture.

Before we can venture to assume the rôle of teachers in matters agricultural, however, we have much to learn about the methods employed by the native cultivators themselves, and the more we may be able to unravel and elucidate the underlying scientific basis of their practices, so much the more shall we be able to encourage them to adopt the improvements which may be discovered to be applicable to the peculiar conditions of the country.

Explanation of Plates.

Plate I.

Fig. 1.—Ekona, Cameroons. A Cocoa plantation with Oil Palms; the Cameroon Mountain is seen in the distance.

Fig. 2.—Victoria Botanic Gardens, the Limbe river and Palms.

Plate II.

Fig. 3.—Buea, Cameroons. Tea bushes about 15 ft. high.

Fig. 4.—Cinchona trees at Buea.

Plate III.

Fig. 5.—Granitic hills near Jos, Northern Nigeria, with bushes of a Cactoid Euphorbia.

Fig. 6.—Buin Yaro on the railway from Zaria to Jos. Natives making grass mats for thatching their circular mud houses. The tall tree is *Parkia filicoides.*

Plate IV.

Fig. 7.—Granitic hills near Jos with a Pagan village among the rocks. A close stockade of columnar Euphorbias surrounds the compound.

XXIX.—LIST OF PLANTS COLLECTED IN NORTHERN NIGERIA BY CAPTAIN A. W. HILL, 1921.

J. Hutchinson.

The flora of Northern Nigeria was first made known to us by Dr. Theodor Vogel, the botanist accompanying the British expedition to the Niger under the command of Captain Trotter in 1841. His collections formed the basis of Bentham & Hooker's *Niger Flora*, edited by Sir William Hooker and published in 1849. Nearly twenty years later one of the finest collections ever brought from Tropical Africa was made in Nigeria by Mr. Charles Barter, attached to the Niger Expedition under Dr. Baikie. Many of Barter's plants were gathered in the Nupé district of Northern Nigeria, and they have mostly been described in the Flora of Tropical Africa and other works.

It was not until about the year 1904 that plant collecting in Northern Nigeria was resumed, and since then Kew has continued to receive a considerable number of dried specimens, mainly from officers attached to the Forestry and Agricultural departments, and also from medical officers. Chief amongst the latter is a finely preserved collection begun by Dr. J. M. Dalziel in 1906 and received through the Imperial Institute. From the determinations made at Kew Dr. Dalziel compiled his most useful *Hausa Botanical Vocabulary*, published in 1916. There are still a number of Dr Dalziel's plants to be finally worked out, and one or two, together with a few collected by Mr. H. V. Lely, Forestry Officer, Northern Nigeria, are made co-types of species described for the first time in the present paper. As Mr. Lely's investigations are still being energetically continued, however, his plants will form the basis of a separate memoir as his material accumulates.

The present is a list of the plants collected in Northern Nigeria in March 1921 by the Assistant Director, who has supplied the following particulars and notes to some of the descriptions. The collection consists of some 35 specimens gathered round Jos and Naraguta on the Bauchi Plateau, chiefly among the dry granitic hills, at an elevation of about 4,000 ft. Though it was the close of the long dry season the number of plants in flower was remarkable and in the short time available only comparatively few of the plants in flower were collected. Of the other plants, some 20 in number, the majority came from Zaria and Maigana about 15 miles from Zaria. Here the elevation is about 2,000 ft., and the soil is either laterite or granitic. As on the Plateau, the ground was very hard and dry since there had been no rain for about six months. A few plants were also found at Kaduna. Seeds of several plants were brought home and some of these have germinated, and may prove to be of horticultural interest. The new species of *Ochna* is a plant

of singular beauty, and the *Vigna* is also attractive with its large lavender-violet flowers which are very sweet-scented.

Bixaceae.

Cochlospermum tinctorium, *Rich.*; Fl. Trop. Afr. i. 113.
Naraguta, 21 March, No. 24; Kaduna, 18 March, No. 50.

A common low growing savannah plant of Upper Guinea, defoliate at flowering time, and ranging from the north bank of the Gambia to the hinterland of Lagos and Northern Nigeria. Common in Nigeria, the large orange-yellow flowers studding the dry ground, being very conspicuous and beautiful; roots yield yellow dye used for dyeing thread yellow in Hausa country. Hausa "Turri."

Polygalaceae.

Securidaca longipedunculata, *Fres.*; F.T.A. i. 134.
Jos, 21 March, No. 1, also seen at Maigana and Zaria; shrub 6–10 ft.

One of the commonest and most widely-spread African shrubs, ranging over the whole of Tropical Africa, and well adapted by its samaroid fruits for distribution by the wind. It extends southwards to Delagoa Bay, the northern Transvaal and Amboland, S.W. Africa. A very beautiful shrub with sweet scented flowers which should be cultivated in gardens in N. Nigeria.

Malvaceae.

Cienfuegosia heteroclada, *Sprague* in Kew Bull. 1907, 48.
Naraguta, 22 March, on ground recently burnt, No. 25.

A rare plant only found in Northern Nigeria, where it appears in the bush after burning. This is the second gathering of the species, which was discovered at Kontagora by Dr. J. M. Dalziel in 1905.

Ochnaceae.

Ochna Hillii, *Hutchinson*, sp. nov. [Ochnaceae-Ochneae]; affinis *O. leptocladae*, Oliv., sed foliis sub anthesi partim evolutis, floribus majoribus, antheris longioribus differt.

Frutex usque ad 3 m. altus, sub anthesi fere efoliatus, laxe ramosus; caules erecti, basin versus circiter 5 mm. crassi, ramis lateralibus multifloris usque ad 10 cm. longis cinereis, labris. *Folia* matura obovato-oblanceolata vel oblanceolata, basi attenuata, apice obtusa vel fere rotundata, 9–12 cm. longa, 2–4 cm. lata, firme chartacea, margine crenato-serrulata, cartilaginea, utrinque tenuiter reticulata, glabra; costa media utrinque prominens; nervi laterales utrinsecus 12–14, basales ascendentes, superiores arcuati et ramosi, utrinque straminei et prominentes; petioli 3–4 mm. longi, marginibus acutis cartilagineis; stipulae mox deciduae, oblongo-lineares, apice rotundatae, 0·7–1 cm.

longae, membranceae, apice interdum bifidae, glabrae. *Flores* in ramis annotinis fasciculati, 4–5-nati, flavi; pedicelli 1·5–2 cm. longi, graciles, basi articulati, glabri. *Sepala* oblongo-elliptica, apice rotundata, 6 mm. longa, 4 mm. lata, viridia, multinervosa, glabra. *Petala* obovata, vix unguiculata, 1 cm. longa, 5 mm. lata. *Filamenta* antheris longiora; antherae 2·5 mm. longae, rimis dehiscentes. *Carpella* 6, glabra; stylus 6 mm. longus. *Fructus* bicarpellatus, calyce persistente accrescente coccineo cinctus, carpellis subglobosis nigris nitidis usque ad 0·8 cm. diametro.

Tropical Africa. Northern Nigeria: Jos, among very dry granite rocks, fls & fr., 20 Mar. 1921, Maigana fr. 30 Mar. *A. W. Hill* 2. Kontagora, shrub in open bush, scarce, fls. & fr., *J. M. Dalziel* 97, 380; Nupe; Jeba, *Barter* 1029.

This species is most closely related to *Ochna leptoclada*, Oliv., a short slender stemmed undershrub with a wide range in South Tropical Africa, from the lower Zambesi basin to Angola. The shrub is of great beauty, the leafless twigs being covered with a profusion of clear nankin-yellow flowers about the size of Plum blossom. It is also a beautiful sight in the fruiting condition when the black carpels are conspicuous on the swollen crimson calyces. A closely allied white-flowered species was seen in the garden of Col. H. W. Laws at Tudun–Wada near Jos, and both are worthy of extensive cultivation in gardens in N. Nigeria.

Leguminosae.

Crotalaria graminicola, *Taub.* ex Baker f. in Journ. Linn. Soc. xlii. 291.

Jos. fl. & fr. 20 March, No. 3.

Also collected by Dr. Dalziel in 1906 at Kontagora, in dry bush after burning. Confined to Northern Nigeria.

Indigofera Dalzielii, *Hutchinson*, sp. nov. [Leguminosae Galegeae]; affinis *I. Schweinfurthii*, Taub., et *I. aspera*, Perr., ab illa foliis petiolatis supra glabris, ab hac foliis trifoliatis foliolis linearibus pilis brevioribus differt.

Herba e rhizomate lignoso orta, usque ad 30 cm. alta; caules erecti vel procumbentes, flexuosi, appresse pubescentes. *Folia* inferiora simplicia, superiora trifoliolata, sessilia vel brevissime petiolata; foliola linearia vel lineari-oblanceolata, acute mucronata, 2·5–6 cm. longa, 4–7 mm. lata, chartacea, supra glabra, infra appresse-albido-pubescentia, 1-nervia; stipulae lineares vel subulatae, acutae, 7–8 mm. longae, pubescentes. *Racemi* axillares, foliis multo majores, usque ad 12 cm. longi; pedunculi pubescentes; bracteae subulatae, 5 mm. longae, fere glabrae; pedicelli ad 1·5 mm. longi, pubescentes. *Calyx* subaequaliter 5-partitus, segmentis subulato-lanceolatis acutis 4 mm. longis piloso-pubescentibus. *Vexillum* rubro-purpureum, suborbiculare, circiter 4·5 mm. diametro, extra superne laxe pubescens. *Alae* et carina roseo suffusa, circiter 5 mm. longa.

Fructus reflexus, rostratus, rectus, fere 1·5 cm. longus, appresse strigoso-pubescens.

Tropical Africa. Northern Nigeria: Kontagora, in bush after burning, 7 Jan. 1906, *J. M. Dalziel* 27; Jos, 20 March, *A. W. Hill* 4; Naraguta, *H. V. Lely* 20.

Indigofera pulchra, *Vahl*; F.T.A. i. 76; Baker f. in Journ. Bot. 1903, 193.

Jos, fls. & young fr. 21 March, No. 5.

Widely distributed in North and West Tropical Africa; According to Dalziel, used with grass in thatching; vernacular "Baki-bunu."

Alysicarpus rugosus, *DC.*; F.T.A. i. 171.

Zaria, No. 36.

Sphenostylis Schweinfurthii, *Harms* in Engl. Bot. Jahrb. xxvi. 309.

Naraguta, fls. yellow, No. 26.

Extends from Kontagora (*Dalziel* nos. 15, 402) to the Seriba Ghattas in the South Eastern Sudan. Vernacular "Waken kurege" (*Dalziel*).

Dolichos Lelyi, *Hutchinson*, sp. nov. [Papilionaceae-Phaseoleae]; affinis *D. Schweinfurthii*, Harms, sed foliolis maturis lineari-lanceolatis acutis stipulis deciduis calyce subaequaliter lobato differt.

Caules simplices, circiter 3 dm. alti, conspicue flexuosi, plus minusve compressi et prominenter costati, pilosi vel fere glabri, internodiis 4–7 cm. longis. *Folia* sub anthesi immatura, trifoliolata, subsessilia vel breviter petiolata, foliolis subaequalibus lineari-lanceolatis basi angustatis apice acutis 13–16 cm. longis 1–2 cm. latis marginibus undulatis prominenter trinervis utrinque parce pubescentibus; petioli usque ad 1·5 cm. longi, basi tumidi; petioluli 4 mm. longi, crassi; stipulae deciduae, lanceolatae, acutae, circiter 1 cm. longae, costatae; stipellae persistentes, subulatae, 2–2·5 mm. longae. *Flores* axillares, fasiculati, 3–5–nati; pedicelli graciles, usque ad 2 cm. longi, glabri vel pilosi; bracteolae sub calyce duae, oppositae, subulatae, 1 mm. longae, glabrae. *Calyx* oblique campanulatus; tubus 5 mm. longus, glaber, lobo dorsale triangulari-lanceolato pubescente ceteris late triangularibus acutis circiter 1·5 mm. longis glabris. *Corolla* violacea, 3 cm. longa; vexillum suborbiculare, 2 cm. latum, extra minute maculatum; alae carina subaequales. *Ovarium* glabrum; stylus stramineus, basin versus incrassatus, stigmate terminale pilis violaceis circumdato. *Legumen* 5–6 cm. longum, sicco nigrum, marginibus laxe pilosis exceptis glabrum. *Semina* suborbicularia, 7 mm. lata, nitida, obscure venosa.

Tropical Africa. Northern Nigeria: Naraguta, in clumps, *H. V. Lely* 44; Naraguta, *A. W. Hill* 27.

Vigna violacea, *Hutchinson*, sp. nov. [Papilionaceae-Phaseoleae]; affinis *V. pubigerae*, Baker, et *V. Kotschyi*, Schweinf., ab

illa foliis sub anthesi partim evolutis lateraliter lobulatis, ab hac calyce majore laxe pubescente, vexillo extra glabro differt.

Caules volubiles, elongati, sub anthesi efoliati, appresse albido-pubescentes, internodiis 9–10 cm. longis. *Folia* trifoliolata, petiolata, utrinque dense appresse pilosa; foliola trilobata, lateralia brevissime petiolulata, terminalia petiolulo 0·8–1 cm. longo dense tomentoso-pubescente; stipulae oblongo-lanceolatae, subobtusae, circiter 4 mm. longae et 1·5 mm. latae, extra appresse pilosae; stipellae oblongae, 1–1·25 mm. longae, glabrescentes. *Pedunculi* elongati, demum 30 cm. longi, breviter pubescentes. *Flores* subumbellati, circiter 5–6–nati, lavendulaceo-violacei. *Calyx* oblique campanulatus, 1 cm. longis, extra parce pubescens, lobis dorsalibus subconnatis ceteris triangularibus. *Vexillum* late orbiculare, emarginatum, breviter unguiculatum, circiter 3 cm. diametro, ungue 4-appendiculato, appendiculis biseriatis rotundatis. *Alae* et carina circiter 3 cm. longae, purpureo-suffusae. *Antherae* 2 mm. longae. *Stylus* curvatus, superne unilatere dense villosus, apice semisagittatus, acutus. *Legumen* lineare, circiter 8 cm. longum, 4–5 mm. latum, dense tomentellum, basi calyce persistente cinctum. *Semina* sub-quadrangularia, 3–5 mm. lata, fere nigra, subnitida.

Tropical Africa. Northern Nigeria: Jos, and Teria, March 20, 23, 1921, *A. W. Hill* 6.

The flowers are a beautiful lavender-violet and very sweet scented. The sparse foliage and stems are grey-green. An attractive climber which would take the place of the Sweet Pea in N. Nigerian gardens. Plants are growing at Kew.

Dichrostachys nutans, *Benth.*; F.T.A. ii. 333.
Near Zaria, No. 37.

A very common shrub or small tree, widely spread in Africa and cultivated in most other tropical countries.

Combretaceae.

Combretum herbaceum, *Don*; Engl. Monogr. Afr. Combret 67.
Near Jos, No. 8.

A species of *Combretum* with a curious habit, the short stems arising from a woody rhizome; flowers in the dry season after grass fires. Vernacular "Taro" (*Dalziel*, Katagum). Occurs in the savannah from Sierra Leone to the eastern Chari.

Umbelliferae.

Hydrocotyle asiatica, *Linn.*; F.T.A. iii. 6.
Jos, in fields, 21 March, No. 9.

This plant mimics very closely certain species of *Geophila* (*Rubiaceae*), and especially in the fruiting stage might readily be mistaken for a species of that genus. The species is widely spread in the tropics of the Old World, and is somewhat variable according to situation. The American plant sometimes referred

to this species, however, is quite distinct. It is *H. repanda*, Pers.

RUBIACEAE.

Oldenlandia grandiflora, *Hiern*; F.T.A. iii. 57.
Zaria, 25 March, No. 38 and Maigana, No. 46.

Mussaenda arcuata, *Poir.*; F.T.A. iii. 68.

In Mr. Bourke's garden, from valley near Naraguta, No. 28. Flowers creamy-white, with orange hairs at the throat, turning brown on the second day. The enlarged petaloid sepals so characteristic of the genus are only occasionally developed in this species, which ranges from Sierra Leone across Northern Tropical Africa down the eastern part of the continent as far as the Zambesi basin. An interesting and useful garden plant.

Feretia canthioides, *Hiern*; F.T.A. iii. 116.

Near Zaria, 25 March, No. 39; bushes about 4 ft. high, flowering without leaves; flowers creamy-white, flushed with pink.

This species has been gathered in Senegambia, Northern Nigeria, and in the Central Chari region, but not, so far as we are aware, from any intermediate localities. The flowers are sweet-scented and produced in great profusion along the almost leafless shoots, and like the *Ochna* it is a very desirable plant for cultivation in gardens in the Northern Provinces.

Belonophora Morganae, *Hutchinson*, sp. nov. [Rubiaceae-Alberteae]; affinis *B. coffeoidei*, Hook. f., sed foliis lanceolato-ovatis, stipulis angustioribus, receptaculis glabris differt.

Frutex; rami floriferi subteretes, glabri, internodiis 3–4·5 cm. longis. *Folia* lanceolato-ovata, sensim acuminata, subacuta, basi subacuta vel leviter rotundata, 10–16 cm. longa, 3–6·5 cm. lata, pallide viridia, firme chartacea, glabra; nervi laterales utrinsecus 5–6, arcuato-ascendentes, infra prominuli, venis transversis laxis a costa sub angulo recto abeuntibus; petioli vix 1 cm. longi, utrinque anguste alati; stipulae interpetiolares, e basi lanceolato filiformi-subulatae, 1–1·5 cm. longae. glabrae. *Flores* axillares, 3-4-nati, subsessiles, bracteis imbricatis ovatis ciliatis subtendentibus. *Receptaculum* urceolatum, 2 mm. longum, glabrum. *Calycis* lobi imbricati, late ovati, 1·75 mm. longi et lati, coriacei, marginibus angustissime hyalinis. *Corollae tubus* cylindricus, 1 cm. longus, circiter 2 mm. crassus, glaber; lobi 5, oblique oblongo-elliptici, apice rotundati, 6–8 mm. longi, 3·5–4 mm lati, subcoriacei, obscure venosi, glabri. *Antherae* inclusae, medio corollae tubi insertae, 4·5 mm. longae. *Ovarium* 2-loculare; stylus brevis, 4·5 mm. longus, ad medium bilobus. *Fructus* non visus.

TROPICAL AFRICA. Northern Nigeria: Jos, *Mrs. Cope Morgan*. Collected by Mrs. Cope Morgan, with other plants, and sent to me on the morning I left the plateau.—A. W. H.

Pentanisia Schweinfurthii, *Hiern*; F.T.A. iii. 131.

Naraguta, low tufted herb with blue flowers, No. 29.

Widely spread in East Tropical Africa; gathered in Nigeria for the first time (also at Naraguta) by Major E. J. Lugard in 1914, who notes the flowering of the species in blazing sunshine at the driest time of the year in dry stony soil.

Compositae.

Vernonia pumila, *Kotschy et Peyr.*; F.T.A. iii. 292.

Naraguta, No. 30.

Occurs also in dry stony places in Uganda (*Speke & Grant*) and on the Bahr el Ghazal (*Broun*). A low plant about 3 inches high, leafless at the time of flowering; root-stock with long tapering tubers which no doubt conserve the food supply for the dry season.

Helichrysum Mechowianum, *Klatt* in Ann. Naturh. Hofmus. Wien, vii. 101. (*H. congolanum*, Schltr. & O. Hoffm.).

Jos, 21 March, No. 11; much resembles a *Petasites*, flowering before the leaves appear.

This species was previously recorded from Agome, Togoland, Dolo, Congo, and from Angola, so Nigeria furnishes another link in its chain of distribution. The yellow flowers are very sweet-scented.

Coreopsis Barteri, *O. & H.*; F.T.A. iii. 390.

Jos, 21 March, No. 12.

Apparently confined to Nigeria. This would form a very useful garden annual. Plants are growing at Kew from seed brought back from Jos.

Senecio baberka, *Hutchinson* in Kew Bull. 1913, 180.

Jos, 20 March, No. 13.

Senecio Cliffordianus, *Hutchinson*, sp. nov. [Compositae-Senecionideae]; affinis *S. barbertonico*, Klatt, sed capitulis plus minusve simpliciter umbellatis, caulibus per anthesin efoliatis differt.

Caulis crassus, carnosus, per anthesin efoliatus, cicatribus transverse ellipticis notatus. *Folia* squamiformia, decidua, lanceolata, basi crassa, circiter 4 mm. longa, glabra. *Pedunculi* terminales, dense umbellati, simplices vel 2–3–furcati, 2–2·5 cm. longi, glabri, sicco acute costati, bracteis linearibus paucis circiter 3·5 mm. longis ornati. *Capitula* discoidea, oblongo-cylindrica, 2·5 cm. longa, medio vix 1 cm. diametro. *Involucri bracteae* circiter 8, lineares, acutae, 1·5 cm. longae, 2·25 mm. latae, extra trisulcatae, glabrae marginibus latis membranaceis subhyalinis. *Achaenia* linearia, pluricostata, 6 mm. longa, glabra. *Pappus* albus, gracilis, usque ad 1·5 cm. longus. *Corolla* pallide flava, anguste cylindricus, apicem versus paulo ampliata; tubus 1·6 cm. longus, glaber; lobi anguste lanceolati, subobtusi, 1·5 cm. longi.

Tropical Africa. Northern Nigeria: Jos, fl. 21 Mar. 1921, *A. W. Hill* 14.

This species is named in compliment to His Excellency Sir Hugh Charles Clifford, G.C.M.G., Governor-General of Nigeria. It belongs to a small group of *Senecio* characterised by its fleshy stems and discoid, umbellate capitula. The nearest allied species is *S. barbertonicus*, Klatt, from near Bulawayo, Rhodesia, whilst there are very similar species at Cape Juby and in the Canary Islands.

Apocynaceae.

Strophanthus sarmentosus, *A.P.DC.*; F.T.A. iv. i. 180.
Jos, among granite rocks, 20 March, No. 15.
Distributed from Gambia to Old Calabar and Northern Nigeria; probably also in Uganda.

Boraginaceae.

Heliotropium strigosum, *Willd.*; F.T.A. iv. ii. 41. Jos, No. 54.

Trichodesma physaloides, *A. DC.*; F.T.A. iv. ii. 46.
Maigana, flowers pale blue, No. 47.
Widely distributed in East and South Tropical Africa; first recorded from Nigeria in 1916 by Mr. Lamb (No. 95), from Kaduna.

Convolvulaceae.

Evolvulus alsinoides, *Linn.*; F.T.A. iv. ii. 67.
Naraguta, 20 March, No. 31. Zaria, 25 March, small mauve-blue flowers, No. 40.

Ipomoea fragilis, *Choisy*; F.T.A. iv. ii. 165.
Jos, 20 March, flowers lemon yellow, No. 16.
Ranges across to Djurland in the Eastern Sudan and in the Belgian Congo.

Solanaceae.

Schwenkia americana, *Linn.*; F.T.A. iv. ii. 260.
Zaria, 18 March, No. 41.

Scrophulariaceae.

Cycnium petunioides, *Hutchinson*, sp. nov. [Scrophulariaceae-Gerardieae]; affinis *C. camporo*, Engl., sed foliis sessilibus ovatis vel ovato-lanceolatis nervis reticulatis, calyce majore differt.

Herba circiter usque ad 0·9 m. alta; caulis erectus, dense glanduloso-pilosus, internodiis 2–3·5 cm. longis. *Folia* sessilia, ovata vel ovato-lanceolata, apice subacuta, basi leviter rotundata, 3–4·5 cm. longa, 1·3–2·3 cm. lata, chartacea, obtuse et irregulariter serrata, utrinque scabrido-glandulosa; nervi laterales utrinsecus 5–6, ramosi, utrinque prominuli. *Pedunculi* supra-

axillares, 1-flori, circiter 1·3 cm. longi, glanduloso-pilosi, apice bibracteati, bracteis oppositis lanceolatis obtusis foliaceis 7–8 mm. longis 2 mm. latis. *Calyx* tubulósus, viridis; tubus 1 cm. longus, oblongo-campanulatus, glanduloso-hispidus, lobis 5 ovatis obtusis 6 mm. longis 4–5 mm. latis. *Corolla* alba; tubus 3·5 cm. longus, supra medium unilateraliter constrictus, glanduloso-pilosus; lobi 4, ovato-orbiculares, venosi, circiter 1·5 cm. longi et lati, utrinque laxe puberuli. *Stamina* 4, infra tubi medium inserta; filamenta 5–6 mm. longa, crassa; antherae 4–5 mm. longae. *Ovarium* depresso-globosum, glabrum, stylo gracile.

Tropical Africa. Northern Nigeria: Jos, 21 Mar. 1921, corolla white, *A. W. Hill* 17. Naraguta, *H. V. Lely* 17.

A handsome herbaceous plant or subshrub with conspicuous white Petunia-like flowers. It would be a useful garden plant in Northern Nigeria. The white flowers turn a deep indigo blue when fading and in the press.

Scoparia dulcis, *Linn.*; F.T.A. iv. ii. 354.
Zaria, 18 March, No. 42.

Striga lutea, *Benth.*; F.T.A. iv. ii. 409.
Kaduna, 18 March, No. 51.

Bignoniaceae.

Stereospermum Kunthianum, *Cham.*; F.T.A. iv. ii. 518.
Maigana, No. 48.

Pedalineae.

Sesamum radiatum, *Sch. & Thonn.*; F.T.A. iv. ii. 557.
Zaria, 26 March, in prison garden, fls. and fruits, No. 43.

Labiateae.

Ocimum knyanum, var. **astephanum,** *Baker*; F.T.A. v. 346.
Jos, Zaria, and Kaduna, fls. mauve, No. 18.

This plant has not been collected in Nigeria since first gathered by Barter on the Niger Expedition near Lōm, Nupe, but it was found in abundance around Kaduna and Zaria and also on the Plateau. The flowers are a beautfiful pale mauve and show considerable variations in the markings.

Orthosiphon bracteosus, *Baker*; F.T.A. v. 375.
Jos, 21 March, No. 19; terminal bracts pink after the manner of the Mediterranean *Salvia Horminum*, L.; a plant worthy of cultivation in gardens in Northern Nigeria.

Thymelaeaceae.

Lasiosiphon Kraussii, *Meisn.*; F.T.A. vi. i. 231.
Zaria, 25 March, No. 44, Naraguta No. 32, and Jos, 20 March, No. 20.

As the late Professor Pearson pointed out in the Flora of Tropical Africa, this species is extremely variable, a fact well shown in the case of the Nigerian specimens before us, ranging from perfectly glabrous to densely hairy plants, and there is considerable range in the shape of the leaves and involucral bracts.

Santalaceae.

Thesium viride, *A. W. Hill*; F.T.A. vi. i. 426.
Kaduna, 18 March, No. 52.

Thesium viride, *A. W. Hill*, var. *pubescens*, var. nov., a typo ubique breviter pubescens differt.
Maigana, March 25, *A. W. Hill* 49. Sokoto Province, 12 June 1907, *J. M. Dalziel* 549.

Euphorbiaceae.

Euphorbia hirta, *Linn.*; F.T.A. vi. 1. 496.
Zaria, 18 March, No. 45.

Euphorbia lateriflora, *Sch. & Thonn.*; F.T.A. vi. i. 552.
Jos, 21 March, no. 21.

Lepidoturus laxiflorus, *Benth.*; F.T.A. vi. i. 913.
Naraguta, male and female fls., No. 33.

Liliaceae.

Asparagus Pauli-Guilelmi, *Solms-Laub.*; F.T.A. vii. 428.
Jos, 21 March, no. 23; flowers sweet-scented.
Urginea indica, *Kunth*; F.T.A. vii. 540.
Naraguta, no. 35.
Urginea nigritana, *Baker*; F.T.A. vii. 542.
Naraguta, no. 34.

XXX.—MISCELLANEOUS NOTES.

Sir John Harrison.—We note with pleasure in the recently issued list of Birthday Honours the name of Professor J. B. Harrison, C.M.G., Director of Science and Agriculture, British Guiana, upon whom His Majesty has been graciously pleased to confer the honour of Knighthood.

Professor P. van der Bijl.—We learn with pleasure that Mr. P. van der Bijl, M.A., F.L.S., formerly in charge of the Natal Herbarium, has been appointed Professor of Phytopathology and Mycology at the University of Stellenbosch, Union of South Africa.

J. S. J. McCall.—We have to record with regret the death of Mr. J. S. J. McCall, who was appointed Director of Agriculture in the Tanganyika Territory on November 14th, 1920 (*K.B.*, 1920, p. 285). Mr. McCall was previously Director of Agriculture,

Nyasaland, to which post he was appointed in July, 1908. He was on a visit to Kenya Colony to consult the Director of Agriculture, when he was suddenly taken ill at Kijabe and died in Nakaru Hospital on February 4th.

Coco-de-Mer in the Seychelles.—We are indebted to His Excellency the Governor of the Seychelles for permission to publish extracts from his letter to Kew with reference to the measures that are being taken to protect the Coco-de-Mer (*Lodoicea*) trees in the Seychelles.

This information has kindly been furnished in reply to an enquiry from Kew on the subject of the preservation of this remarkable palm. His Excellency informs us that provisions have been made in the various leases to planters, etc., to ensure the protection of the palms.

It is a matter of great satisfaction to learn that the interest and importance of the Coco-de-Mer is fully appreciated in the Seychelles, and that the Government are so effectively safeguarding this unique species.

The following paragraphs are taken from His Excellency's letter of February 19th, 1921 :—

"In the two valleys acquired by the Government about 1890, viz., Anse Marie Louise and Fond Ferdinand, there are some 3000 coco-de-mer trees of all ages. These palms grow thickly alongside two valleys which cover 40 acres of land. The two Crown lands have been leased since 1900. As the lease of Fond Ferdinand expired in 1919, a new lease was entered into at that time, by which the new lessee is not allowed to lop, or cut any tree, or make any plantation within a reserve of 25 arpents where the coco-de-mer palms grow under normal conditions. As soon as the lease of Marie Louise expires (1928), a reserve of 17 arpents already delimited, will also be made under the same conditions.

"It has been found by experience that coco-de-mer palms require moisture for their growth, and that they should not be suddenly exposed to the sun or scorched by bush fire during the first 40 years of their growth. Under these circumstances, it is imperative that the lessees should not be allowed the free enjoyment of the reserved areas, as in spite of all precautions, cleaning by fire or by removing shade trees will cause the destruction of young palms. The two valleys in question are besides thickly covered with all other Seychelles palms except *Roscheria*, and they form a unique spot.

"There are, besides these two valleys, other Crown lands, viz., at Curieuse Island, where the palms are also protected under special clauses of the lease. As at Marie Louise and Fond Ferdinand, the lessee has no right to injure or cut the heart leaves. They are granted permission to gather the fallen ripe nuts for sale. At Fond Ferdinand the lessee is bound to

plant 25 nuts every year. Savoie, New Come, Anse Kerlan, Anse Georgette, Pointe Chevalier, Fond Boffay, Pointe Zanguilles are other Crown lands of Praslin where coco-de-mer palms grow here and there, but on these Crown lands the soil is too much worn out to allow the palms to grow under normal conditions, and they are all stunted in growth.

"Attempts to grow coco-de-mer palms in Maho have succeeded well. There are a few at Government House and at the Botanic Station which are bearing. Therefore, no apprehension need be felt regarding the disappearance of this unique species of palm."

Studies in French Forestry.*—This book is the work of Mr. Theodore S. Woolsey, Jr., a consulting forester of the United States, America, and executive member of the Inter-allied War Timber Committee, Paris, 1917–1919, with two chapters by Mr. William B. Greeley, an official of the United States Forest Service. The work is in English and is descriptive of the principal features of French Forestry as they appeal to a foreign student, amplified by extracts from French literature and observations by French forest officers. The book was in course of preparation before the war, but its publication was postponed, and it now carries French forestry to a post-war date. This will give it considerable historic value in the future, for it not only places upon record the important part played by the forests of France in the prosecution of the late war and describes the activities of the Forestry Section of the United States Army in France, but indicates the ingenious methods and precautions adopted by the French people to preserve their forests from destruction, and to maintain as far as possible the sequence of their working plans, without starving the allied army or seriously crippling French industry by too strict economy in the provision of timber. The first chapter reviews the economic, legal, and administrative problems affecting the forests and is followed by a chapter describing the influence of the forests on the country, climate and people. The various forest regions are then reviewed and descriptions given of the various commercial trees, and the steps taken to establish and preserve forests in places subject to serious soil erosion, the control of erosion in mountainous regions being given special prominence. Considerable space is devoted to the historic and economic associations of the resin- and turpentine-yielding forests of Maritime Pine established upon the sand dunes of the Landes and Gironde, but the subject is not overdone, for this is one of the classic illustrations of a large area of waste, desolate, and unhealthy land, which provided a precarious living for a few peasants, being transformed into a valuable residential

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* "Studies in French Forestry," by Theodore S. Woolsey, Jr., with two chapters by William B. Greeley, published in New York by Messrs. John Wiley & Sons, Inc., and in London by Messrs. Chapman & Hall, Ltd., 1920. Price 36/– net.

and revenue-producing region, carrying a considerable population solely by the establishment of forests. Working plans, mensuration, general forest administration and the work of the American Forest Engineers in France are given due attention in other parts of the book, whilst there are twelve appendices dealing with special subjects, such as the forest and springs; forests from a physical, economic, and social view-point; silvics of important forest species; statistics of public and private forests; French forest literature (with over 900 references); German comments on French forestry with a comparison with German methods; forests of Alsace-Lorraine, etc. In order to establish the American Army as a fighting unit in France and to carry its operations to the end of the war we are told that it required 450,000,000 board feet of round or manufactured timber and 650,000 cords of fuel wood. This was at the rate of 1½ tons for every soldier sent and 75 per cent. of it was cut from the forests of France. The work numbers 550 pages, including a number of illustrations and a good index. Although it deals solely with matters in France, it is a book for general study, and should find a place in the library of every forester and in every class room where forestry is taught. W. D.

Eleocharis Jamesonii.—This Cyperaceous plant was collected by *Jameson*, No. 369, on the Savannah of Guayaquil, Ecuador, and referred by Steudel to the genus *Chaetocyperus* under the name *Chaetocyperus Jamesoni*, Steud., Syn. Pl. Cyper., p. 74.

Whilst endeavouring to identify a West Indian species of *Eleocharis* I found that Jameson's plant had never been recognised as being a member of this genus to which it properly belongs and it is therefore placed there under the original specific name as follows :—

Eleocharis Jamesonii, *N. E. Brown* [Cyperaceae-Scirpeae], comb. nov.—*Chaetocyperus Jamesoni*, Steud., Syn. Pl. Cyper., p. 74. N. E. B.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 7] [1921

XXXI.—REVISION OF THE GENUS TRYPHOSTEMMA.

J. Hutchinson and K. Pearce.

For some time past it has been found difficult to determine specimens of the African genus *Tryphostemma* (*Passifloraceae*), owing to the large number of described species since the publication of the second volume of the Flora of Tropical Africa. In that work the genus was represented by a single species, *Tryphostemma zanzibaricum*, Mast., besides two species of *Basananthe*, Peyr., now considered synonymous. The present paper presents a working key and an enumeration of the known species of the genus, although the material of several of them is still far from adequate. The specimens preserved in the Kew Herbarium and the Natural History Museum, South Kensington, are included, and our thanks are due to Dr. A. B. Rendle for allowing us to examine those under his charge, and to Mr. E. G. Baker for supplying the description of *T. reticulatum*.

The genus *Tryphostemma* was founded by Harvey* for a Natal plant, *T. Sandersonii*, a species without petals. In 1871, Masters† added a second species from Zanzibar, *T. zanzibaricum*, also without petals. Subsequently several species have been described in which well developed petals are present, and Engler in 1892 pointed out the desirability of including *Basananthe*, Peyr. He divided the genus into three sections, I. *Eutryphostemma*, petals absent and the outer part of the corona with one series of fimbrillae; II. *Neotryphostemma*, petals present, and the corona as in the preceding section; and III. *Basananthe*, petals present, outer part of corona with one series of fimbrillae and one series of small inflexed teeth. Although these features may be constant, they are not readily ascertainable from dried specimens, and we have consequently employed other and more obvious characters, based on the leaves and stipules, from which a natural classification seems to result.

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* Harv. Thes. Cap. i. t. 51 (1859).

† Fl. Trop. Afr. ii. 508.

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The following is a summary of the distribution of the species, which are apparently quite local :—

Angola, *T. littorale*, *T. Baumii*, *T. reticulatum*, *T. Gossweileri*. South West Africa, *T. heterophyllum*. Eastern Soudan, *T. niloticum*. Uganda, *T. Hanningtonianum*. Kenya Colony, *T. Snowdenii*. Tanganyika Territory, *T. Hanningtonianum*, *T. Volkensii*, *T. zanzibaricum*, *T. lanceolatum*, *T. longifolium*, *T. Stuhlmannii*, *T. pilosum*. Nyasaland, *T. apetalum*. Rhodesia, *T. pedatum*, *T. apetalum*, *T. parvifolium*. Portuguese East Africa, *T. trilobum*, *T. Schinzianum*. Transvaal, *T. Schlechteri*, *T. sagittatum*, *T. viride*. Natal, *T. polygaloides*, *T. Sandersonii*, *T. nummularium*.

Series I. **Lobatifoliae**. Leaves 3–5 lobed.

Stipules filiform :

Inflorescence not tendriliform ; stems short and simple :

Leaf lobes 3–5, linear or lanceolate, serrate ; petiole very short ; flowers about 5 mm. long - - - - - 1. *Schlechteri*.

Leaf lobes 3, oblanceolate, entire or obscurely toothed near the base ; petiole 2–2·5 cm. long ; flowers 1 cm. long - - 2. *heterophyllum*.

Inflorescence ending in a tendril :

Leaves 3- or rarely imperfectly 4–5-lobed ; petiole about 2 cm. or more :

Mature leaves glabrous or nearly so ; flower buds oblong - - - - 3. *Hanningtonianum*.

Mature leaves strigose-pubescent below ; flower buds globose :

Branches glabrous ; petiole about 2·5 cm. long - 4. *Volkensii*.

Branches rather densely pilose ; petiole about 0·5 cm. long - - 5. *niloticum*.

Leaves 5-lobed, densely strigose-tomentose below ; petiole less than 1 cm. long ; flower buds oblong-ellipsoid - - 6. *Snowdenii*.

Stipules large and foliaceous :

Leaves 3-lobed ; segments more or less ovate :

Leaves subsessile ; lobes almost equal, more or less rounded, sharply and irregularly serrate - - - - 7. *trilobum*.

Leaves petiolate; terminal lobe much longer than the lateral, more or less triangular :
Leaves doubly sharply serrate; petioles about 5 mm. long; Transvaal - - - 8. *sagittatum.*
Leaves simply serrate; petiole about 2 cm. long; Portuguese E. Africa - - 9. *Schinzianum.*
Leaves imperfectly 5-lobed; segments linear-lanceolate - - 10. *pedatum.*

Series II. **Integrifoliae.** Leaves not lobed or rarely slightly bilobed.
Stipules large or foliaceous; if small then fimbriate :
Stipules 1·5 cm. long or more, lanceolate ; inflorescence always terminating in a tendril - 11. *apetalum.*
Stipules much less than 1 cm., becoming fimbriate ; inflorescence rarely terminating in a tendril;
Stems branched from near the base, laxly leafy; petiole not glandular - - - 12. *polygaloides.*
Stems simple, densely leafy; petiole with stalked glands - 13. *littorale.*
Stipules filiform or minute, always entire and never foliaceous :
Climbers, peduncles always terminating in a tendril :
Leaves glabrous :
Petioles 1–1·3 cm. long; leaves never more than about 6 cm. long, and always over 1 cm. broad :
Leaves founded at the base; petioles about 1 cm. long not winged - - - 14. *zanzibaricum.*
Leaves cuneate at the base; petioles about 1·3 cm. long frequently winged on one or both sides - 15. *lanceolatum.*
Petioles very short or nothing :
Leaves up to 15 cm. long and 1·2 cm. broad - - 16. *longifolium.*
Leaves 3–3·7 cm. long, 1·2–1·6 cm. broad; petiole rarely exceeding 8 mm. 17. *Stuhlmannii.*

Under surface of ovate leaves pilose, up to 6 cm. long and 2·7 cm. broad - - - 18. *pilosum*.

Erect herbs with short stems; peduncles very rarely terminating in a tendril :

*Leaves linear-lanceolate to ovate or obovate :

Leaves entire, strongly reticulate below :

Leaves obovate, about 6–15 cm. long and 3 cm. broad, decurrent on the petiole - - - - 19. *Baumii*.

Leaves ovate, hairy below, not decurrent on the petiole - - - 20. *reticulatum*.

Leaves toothed, at least in the lower part :

Leaves linear-lanceolate to ovate-lanceolate, only toothed in the lower part, more or less penni-nerved, about 6 cm. long :

Leaves ovate or ovate-lanceolate, averaging about 3 cm. broad, Natal - - - 21. *Sandersonii*.

Leaves lanceolate or linear-lanceolate, averaging about 1 cm. broad, Transvaal - - - 22. *viride*.

Leaves ovate - rhomboid, minutely denticulate all round, dark green, prominently 5-nerved from the base, about 3 cm. long - - - - 23. *Gossweileri*.

**Leaves reniform or orbicular, cordate, about 1 cm. long :

Leaves longer than broad, with undulate margins, mucronate - - - 24. *parvifolium*.

Leaves broader than long, shortly bilobed at the apex, about 1·5 cm. broad, serrate - - 25. *nummularium*.

1. **T. Schlechteri,** *Schinz* in Vierteljahrsschr. Nat. Ges. Zurich, lv. 243 (1910).

South Africa. Transvaal: sandy places near the Sand river, 880 m., fl. & fr. Mar. 1894, *Schlechter* 4596. Warmbaths, in open field, Jan. 1909, *Leendertz* 2062 !

2. **T. heterophyllum,** *Engl.* in Bot. Jahrb. xiv. 388 (1891).—*Basananthe heterophylla,* Schinz in Verh. Bot. Ver. Brand, xxx. 252 (1888).

South Africa. South West Africa: Amboland, *Schinz* 435 !

3. **T. Hanningtonianum,** *Mast.* in Hook. Ic. Pl. t. 1484 (1885); Engl. Bot. Jahrb. xiv. 390 (1891); Engl. Pflanzenw. Ost-Afr. C. 280 (1895).

Tropical Africa.—Tanganyika Territory: Kibwesi; 1000 m. in grass lands, Dec. 1905, *Scheffler* 15 ! in grass on borders of forests, May 1910, *Scheffler* 515 ! Marangu, 615 m. *H. H. Johnston* ! Mainland west of Zanzibar, *Last* ! Kwa-chirossa, *Hannington* ! Derema, Jan. 1893, *Volkens* 117 ! Uganda: Kiwala, rare, Jan. 1917, 1250 m., *Dummer* 3047 ! (a slightly hairy form).

4. **T. Volkensii,** *Harms* in Engl. Bot. Jahrb. xix. Beibl. n. 47, 40 (1894), et in Engl. Pflanzenw. Ost. Afr. C. 281 (1895).

Tropical Africa. Tanganyika Territory: forest above Marangu; 2000 m., June 1894, *Volkens* 2339 ! Marangu, 2000 m., Dec. 1893, *Volkens* 1485 !

5. **T. niloticum,** *Engl.* Bot. Jahrb. xiv. 389 (1891), et in Pflanzenw. Ost. Afr. C. 281 (1895).

Tropical Africa. Eastern Soudan: between Fort Fatiko and Ismailia, *S. S. W. Baker* 214 !

6. **Tryphostemma Snowdenii,** *Hutchinson et Pearce,* sp. nov. *Herba* procumbens, ramosa, ramis costatis junioribus parce pubescentibus. *Folia* palmate quinqueloba, circiter 3·5 cm. longa, supra pilis paucis albidis instructa, infra dense strigoso-tomentosa, lobis obovatis acutis, marginibus stipitato-glandulosis; petioli vix 1 cm. longi, pubescentes; stipulae minutae, filiformes. *Inflorescentia* axillaris, pedunculo 3–4 cm. longo bifloro in cirrhum convolutum exeunte; pedicelli graciles, circiter 7 mm. longi, bracteis minutis filiformibus. *Flores* albi, circiter 7 mm. longi. *Sepala* lanceolato-ovata, basi lata, apice rotundata. *Petala* oblanceolato-spathulata, quam sepala angustiora. *Corona* exterior cupuliformis dentibus biseriatis, intermedia crassa disciformis, interior cupuliformis staminorum basibus circumdata. *Antherae* 1·5 mm. longae. *Ovarium* glabrum, stylis 3 brevissimis stigmatibus capitatis. *Capsula* viridis, ellipsoidea, utrinque angustata, circiter 2 cm. longa. (*See* text figure.)

Tropical Africa. Kenya Colony: Limuru; 2150 m., in short grass land, June 1918, *Snowden* 598 !

7. **T. trilobum,** *Bolus* ex Schinz in Engl. Bot. Jahrb. xv. Beibl. n. 33. 2 (1892) in obs. et in Hook. Ic. Pl. t. 1838.

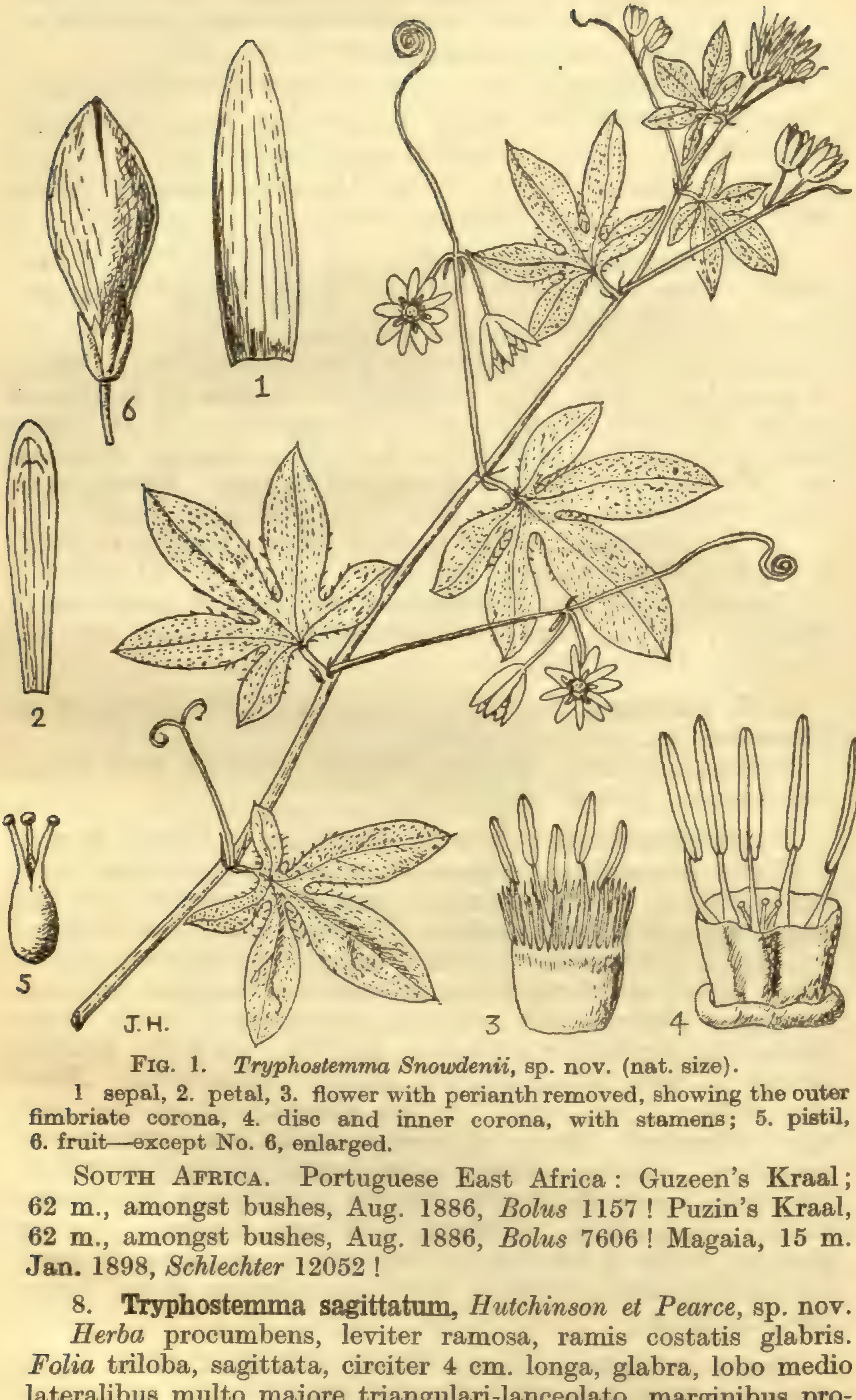

FIG. 1. *Tryphostemma Snowdenii*, sp. nov. (nat. size).

1 sepal, 2. petal, 3. flower with perianth removed, showing the outer fimbriate corona, 4. disc and inner corona, with stamens; 5. pistil, 6. fruit—except No. 6, enlarged.

SOUTH AFRICA. Portuguese East Africa: Guzeen's Kraal; 62 m., amongst bushes, Aug. 1886, *Bolus* 1157! Puzin's Kraal, 62 m., amongst bushes, Aug. 1886, *Bolus* 7606! Magaia, 15 m. Jan. 1898, *Schlechter* 12052!

8. **Tryphostemma sagittatum,** *Hutchinson et Pearce*, sp. nov. *Herba* procumbens, leviter ramosa, ramis costatis glabris. *Folia* triloba, sagittata, circiter 4 cm. longa, glabra, lobo medio lateralibus multo majore triangulari-lanceolato, marginibus profunde et acute serratis; petioli circiter 5 mm. longi; stipulae foliaceae, basi appendiculatae, usque ad 1·5 cm. longae, serratae. *Inflorescentia* axillaris, pedunculo 2–3 cm. longo

bifloro in cirrhum convolutum exeunte; pedicelli circiter 8 mm. longi, bracteis filiformibus. *Flores* pallide virides, circiter 4 mm. longi. *Sepala* ovata, basi lata, apice rotundata. *Petala* obovata, quam sepala angustiora. *Corona*, antherae, et pistillum ut in *T. Snowdenii*.

South Africa. Transvaal: Barberton; 930 m. 1889, *E. E. Galpin* 505! 893 m. Jan. 1889, *J. M. Wood* 47! Komati Poort, Jan. 1902, *J. W. Kirk* 74!

9. **T. Schinzianum,** *Harms* in Engl. et Prantl. Natürl. Pfl. iii. 6. A (1894) et in Engl. Pflanzenw. Ost. Afr. C. 281 (1895).

Tropical Africa. Portuguese E. Africa: Dondo near Beira; in the swamps, Dec. 1899, *Honble. Mrs. E. Cecil*, 250! Kurumadzi R., Gihu, 620 m. Nov. 1906, *C. F. M. Swynnerton* 2089! Mossurizi, 930 m. Feb. 1907, *W. H. Johnson* 145!

10. **T. pedatum,** *Baker f.* in Journ. Bot. xxxvii. 436 (1899).

Tropical Africa. Rhodesia: near the Shashi River; Jan. 1898, *Rand* 67!

11. **T. apetalum,** *E. G. Baker*. in Trans. Linn. Soc. Ser. II. iv. 14 (1894) et in Engl. Pflanzenw. Ost. Afr. C. 280 (1895).

Tropical Africa. Nyasaland: Mt. Zomba; Sept. & Oct. 1891, *A. Whyte*! 1540 m., Dec. 1896, *A. Whyte*! Zomba and vicinity, 930 m., Dec. 1896, *A. Whyte*! Shire Highlands, Milanje, Dec. 1893, *C. F. Scott-Elliot* 8661! 1891, *J. Buchanan* 1063! Rhodesia: Odanzi River Valley, 1915, *A. J. Teague* 477! Between Salisbury and Macheke, 1230 m. Sept. 1911, *Rev. F. A. Rogers* 4022! Salisbury, Dec. 1894, *Marshall*! The Commonage, Salisbury, Nov. 1908, *Rand* 470! 1347! Mazoe, 1500 m. Nov. 1906, *Eyles* 461! 412! Victoria, *Munro* 1548!

12. **Tryphostemma polygaloides,** *Hutchinson et Pearce*, sp. nov.

Caulis erectus, fere e basi ramosus, pallide stramineus, glaber, ramis gracilibus laxe foliatis obtuse costatis. *Folia* simplicia, inferiora ovata, circiter 5 cm. longa et 3 cm. lata, superiora oblongo-lanceolata, basi angustata, apice setoso-acuminata, circiter 4 cm. longa, 1·5 cm. lata, dupliciter serrata, utrinque glabra; petioli 2–5 mm. longi; stipulae minimae, foliaceae, serratae, superioribus fimbriatis. *Inflorescentia* axillaris, pedunculo circiter 3·5 cm. longo 1–2-floro non in cirrhum exeunte; pedicelli circiter 1 cm. longi, bracteis filiformibus. *Flores* lactei, circiter 8 mm. longi. *Sepala* ovata, basi lata, apice rotundata. *Petala* obovata, quam sepala angustiora. *Corona*, antherae et pistillum ut in *T. Snowdenii*.

South Africa. Natal: Umlalazi; 15 m. Mar. 1907, *Medley Wood* 10339!

13. **T. littorale,** *Engl.* Bot. Jahrb. xiv. 388 (1891) in obs.

Basananthe littoralis, Peyr. in Bot. Zeit. xvii. 101 (1859); et in Sitz. Acad. Wien, Math. Nat. xxxviii. 569 (1860); Hiern in Cat. Afr. Pl. Welw. i. 382 (1898).

Tropical Africa. Angola: Benguella; maritime thickets between Benguella and the River Catumbella, flowers and fruits

June, *Welwitsch* 872 ! biennial 5 ft., fls. whitish green, in primary thickets rather rare at Bimbas, 25 km. from Benguella, 4 July 1905, *Gossweiler* 1800 ! Lengue, Benguella, Aug. 1910, *Gossweiler*, 4946 !

14. **T. zanzibaricum,** *Mast.* in Oliv. Fl. Trop. Afr. ii. 508 (1871); et in Trans. Linn. Soc. xxvii. 639 (1870); Engl. Bot. Jahrb. xiv. 388 (1891).

Tropical Africa. Tanganyika Territory : Dar es Salaam; March 1868, *Kirk* !

15. **T. lanceolatum,** *Engl.* Bot. Jahrb. xiv. 388 (1891), et in Pflanzenw. Ost. Afr. C. 281 (1895).

Tropical Africa. Tanganyika Territory : Duga; cultivated land, July 1893, *Engler* 3168 ! East shore of Lake Tanganyika, Oct. 1893, *C. F. Scott-Elliot* 8248 ! Mombasa, Feb. 1902, *Kassner* 46 ! Steppes below Schire, 1000 m., Mar. 1894, *Volkens* 2033 !

16. **T. longifolium,** *Harms* in Engl. Bot. Jahrb. xxxiii. 149 (1904).

Tropical Africa. Tanganyika Territory : Mbarangandu territory; on sandy ground, in sunny places in the Brachystegia forest. Flowers in Dec. *Busse* 673 !

17. **T. Stuhlmannii,** *Harms* in Engl. Pflanzenw. Ost. Afr. C. 280 (1895).

Tropical Africa. Tanganyika Territory : " Zanzibar Coast "; Kisserawe, *Stuhlmann* 6243.

18. **T. pilosum,** *Harms* in Engl. Pflanzenw. Ost. Afr. C. 280 (1895).

Tropical Africa. Tanganyika Territory : " Zanzibar Coast "; Vikindo, *Stuhlmann* 6127.

19. **T. Baumii,** *Harms* in Warb. Kunene-Sambesi Exped. 310 (1903).

Tropical Africa. Angola : On the right bank of the Kubango River below Kueio; 1120 m. on sandy ground, flowers in Nov., July 1899, *Baum* 391 ! Near the fort Princeza Amelia, Kubango, Dec. 1906, *Gossweiler* 4158 !

20. **Typhostemma reticulatum,** *Baker f.*, sp. nov.

Perennis. *Caulis* flexuosus, pubescens. *Folia* alterna, simplicia, ovata vel oblongo-ovata, apice obtusa vel leviter emarginata, basi rotundata vel leviter subcordata, margine integra subcoriacea, superne demum glabra subtus pubescentia, nervis lateralibus utrinque 5–6; lamina 3·5–4·5 cm. longa, 2–2·8 cm. lata, petiolo pubescente 3–8 mm. longo suffulta; stipulae subulatae. *Pedunculi* axillares, saepe biflori. *Calycis tubus* brevissimus; lobi lineari-oblongi, longitudinaliter striati, extus pilis vestiti. *Petala* oblanceolata, membranacea. *Corona* fimbriata. *Capsula* coriacea, extus pubescens, plus minusve 1·5 cm. longa.

Tropical Africa. Angola : along the marshes of Cambambe; in sandy ground, Nov. 1906, *Gossweiler* 3522 (Hb. Mus. Brit.) !

21. **T. Sandersonii,** *Harv.* in Thes. Cap. i. 33 (1859); Harv. & Sond. Fl. Cap. ii. 499 (1861); Mast. in Trans. Linn. Soc. xxvii. 639 (1870).

South Africa. Natal: Durban, *Sanderson* 1864 ! *Gueinzius* ! Inanda, in stony grassy places, *J. M. Wood* 180 !; June 1879, *J. M. Wood* 269 ! Near Krantz Kloof, 500 m., in grass, *R. Schlechter* 3193 ! Natal, *Sanderson* 440 ! *Gerrard* 142 ! 1821 !

22. **Typhostemma viride,** *Hutchinson et Pearce,* sp. nov.

Caulis erectus, e rhizomate ramoso ortus, ramosus vel subsimplex, glaber, pallide stramineus, canaliculatus. *Folia* subsessilia, lanceolata vel lineari-lanceolata, basi obtusa, apice acuta, 4–8 cm. longa, 0·8–1·5 cm. lata, in dimidio inferiore tantum distanter denticulata utrinque glabra, costa et nervis lateralibus ascendentibus infra prominentibus; stipulae minutae et filiformes. *Inflorescentia* axillaris, pedunculo gracile 2-floro 2–3 cm. longo interdum in cirrhum filiformem exeunte; pedicelli circiter 5 mm. longi, bracteis minutis. *Flores* 5 mm. longi. *Sepala* obovata, obtusa. *Petala* nulla. *Corona* tripartita, exterior cupuliformis margine fimbriata et dentibus inflexis, intermedia disciformis, interior cupuliformis staminorum basibus circumdata. *Filamenta* satis lata et membranacea, apice angustata; antherae vix 1 mm. longae. *Ovarium* glabrum, stylis 3, stigmatibus capitatis. *Capsula* ovoidea, circiter 1·5 cm. longa et 8 mm. lata.

South Africa. Transvaal: Barberton; 923 m., stony hillside, Sept., *H. Bolus* 7602 ! 930 m., Apr., *E. E. Galpin* 93 ! Rimers Creek, near Barberton, 923 m., Dec., *Thorncroft* in *Herb. Medley Wood* 4366 !

23. **Tryphostemma Gossweileri,** *Hutchinson et Pearce,* sp. nov.

Caules numerosi, simplices, e rhizomate lignoso polycephalo orti, laxe foliati, pallide straminei, glabri, canaliculati. *Folia* sessilia, ovato-rhomboidea, basi rotundata, apice abrupte acuta, 3 cm. longa, 2 cm. lata, marginibus cartilagineis minute denticulatis, e basi prominenter 5-nervia, utrinque glabra; stipulae minutae et filiformes. *Inflorescentia* folia leviter excedens, pedunculo 3-floro gracile; pedicelli circiter 0·5 cm. longi, bracteis minutis. *Flores* circiter 3 mm. longi. *Sepala* elliptica apice obtusa, trinervia,. glabra. *Petala* quam sepala angustiora. *Corona* duplex, exterior fimbriata, quam petala dimidio brevior, interior cupuliformis filamentis circumdata. *Stamina* et pistillum ut in *R. Snowdenii.*

Tropical Africa. Angola: here and there in the T'Chana of River Kuiriri; near Kassuango, Sept., 1906, *Gossweiler* 4068 !

24. **T. parvifolium,** *E. G. Baker* in Journ. Linn. Soc. Bot. xl. 73 (1911).

South Africa. Rhodesia: hills between Lusitu and Melsetter, 1900 m., fl. Sept. 1906, *Swynnerton* 1415 !

25. **T. nummularium,** *Engl.* in Bot. Jahrb. xiv. 388 (1891).

Basananthe nummularia, Welw. in Trans. Linn. Soc. xxvii. 28, t. 9. (1869); Hiern in Cat. Afr. Pl. Welw. i. 382 (1898).

Tropical Africa. Angola: Huilla; moist sandy thickets about Lopollo, about 1660 m., fl. and fr. Jan.–Feb., *Welwitsch* 871 !

XXXII.—N. W. HIMALAYAN ASTRAGALI OF THE SUBGENUS AEGACANTHA.

R. N. Parker.

There are two comprehensive accounts of the species of *Astragalus* subgenus *Aegacantha*, Bunge, firstly in Bunge's Monograph, in Mém. Acad. Sc. Pétersb. Sér. VII. xi. and xv. and secondly in Baker's account in the Flora of British India, (ii. 133–135). Bunge's treatment is unsatisfactory mainly owing to the number of species admitted, several of which are founded on unreliable characters. A few inaccuracies have crept in which add to the difficulty of using his key to the species. Baker's account is also unsatisfactory, partly because two of his species, *A. multiceps* and *A. leptocentrus*, are not the same as the plants described by Bunge under these names and partly owing to the collection of several distinct species under *A. polyacanthus*. *A. polyacanthus*, Baker, is a plant with a range in elevation from the plains to 12,000 feet unapproached by any other woody plant in N. W. India.

Ths history of the species in question starts with Bentham's account in Royle, Illustr. Bot. Himal. (1839) 199, where three species are briefly described. *A. polyacanthus*, Royle ex Benth. l.c. is a species which has been much confused. There is an original specimen in Bentham's herbarium now at Kew bearing in Bentham's hand "*Astragalus polyacanthus*, Kunawur Royle 1835." This plant presumably came from Sugnam in Kunawar. Bunge omits *A. polyacanthus*, Royle, presumably because *A. polyacanthus*, Wall. Cat. n. 5934 is a *Caragana*.

A. Grahamianus, Royle ex Benth. l.c. 199, is a plant which cannot be identified with certainty. There is a specimen in Bentham's herbarium named by Bentham but it can scarcely be accepted as the type of the species, as this specimen came from Kunawar, whereas the plant described in Royle l.c. came from "Hills surrounding Kashmir." The locality points to *A. Grahamianus*, Royle, being either *A. cicerifolius*, Royle ex Fischer, or *A. psilocentros*, Fisch. The figure in Royle l.c. t. 36, f. 2, as far as it goes points to *A. psilocentros*, Fisch.

Royle's specimen from Kunawar in Herb. Benth. is *A. cicerifolius*, Royle ex Fischer. It is possible that Bentham referred more than one plant to *A. Grahamianus*, Royle, as he has in other cases so that the most satisfactory course seems to be to drop

the name altogether, especially as *A. Grahamianus*, as accepted by Bunge, and by Boissier, Fl. Orient. ii. 307, is a somewhat different plant, which is found west of the Indus in Afghanistan and Chitral, and not as far as is known in Kashmir.

Astragalus multiceps, Wall. The plant described by Bentham is mainly Royle's plant from Shalkar in Hungarung, *i.e.*, Upper Kunawar. Bentham subsequently discovered that Royle's and Wallich's plants were different as the specimen in his herbarium bears "Astragalus multiceps, Kunawar Royle 1835" and later Bentham has written "non Wall." As *A. multiceps*, Wall. Cat. n. 5937 is *A. Candolleanus*, Royle ex Benth. non Boiss., and *A. multiceps*, Royle is *A. Jacquemontii*, Bunge, it is clearly desirable to drop the name *A. multiceps*, Wall.

The species in Fischer's *Synopsis Astragalorum Tragacantharum* (Bull. Soc. Nat. Mosc. xxvi. II. (1853)), from N.W. India are as follows :—

A. cicerifolius, Royle ex Fisch. l.c. 404. There is no doubt about this plant as the type is Jacquemont's n. 1143, which according to Bunge came from Kashmir. The specimen bearing this number in Herb. Hook. does not mention the locality.

A. psilocentros, Fisch. l.c. 405. The type is Jacquemont's n. 109. This plant did not come from Kashmir as stated by Bunge, l.c. 70, but from "Djillapour" a place in the Salt Range between Pind Dadan Khan and Jhelum.

A. Grahamianus, Fischer excl. diagn. Royle, is *A. Jacquemontii*, Bunge.

A. bicuspis, Fisch. l.c. 406. The type is Jacquemont's n. 1695. This plant came from Upper Kunawar between Lapan and Poya and not from Kashmir as stated by Bunge.

A. psilacanthus, Fisch. l.c. 407 is, as regards Jacquemont's nn. 1543 and 1584, *A. polyacanthus*, Royle. Fischer copies the descriptions of *A. polyacanthus*, Royle, and *A. multiceps*, Wall. verbatim from Royle (l.c.) and does not claim to have seen either nor does he refer any specimens to these species.

The species in Bunge l.c. xv. 67–71 are as follows :—

A. zanskarensis, Benth. ex Bunge. The type is Thomson's plant in Herb. Ind. Or. Hook. f. & Thomson, of which there is one sheet in Herb Kew and one in Herb. Calcutta. The Calcutta sheet is not the same as the Kew sheet and is probably *A. Candolleanus*, Royle, or an allied species, but is not in good condition.

A. bicuspis, Bunge, is the same as Fischer's plant.

A. Grahamianus, Bunge, is, as already pointed out, an Afghan plant allied to *A. cicerifolius*, Royle ex Fischer, but apparently sufficiently distinct for specific rank.

A. Jacquemontii, Bunge. The type is Jacquemont's n. 1640 stated by Bunge to have come from N. W. Himalaya and I think almost certainly came from Kunawar.

A. multiceps, Bunge, is Royle's plant and not Wallich's. As already noted it is *A. Jacquemontii*, Bunge.

A. leptocentrus, Bunge, is as regards Jacquemont's n. 1691 only a villous form of *A. Jacquemontii*, Bunge, and probably came from Kunawar and not from Kashmir as stated by Bunge. Griffith's plant from Cabul I have not seen; nor has Boissier (Fl. Orient. II. 307). There appears to have been some mistake over this specimen, as *A. leptacanthus*, Benth. mss. in herb. Kew, is mainly a plant with many more leaflets looking like a villous form of *A. Candolleanus*, Royle.

A. Daltonianus, Bunge. The types are Thomson's specimens from N. W. Himalaya, 10,000–12,000 feet. There are four sheets in Herb. Kew. All the sheets bear a printed label giving the elevation at which the specimens were collected as 10,000–12,000 feet. From the plants being in full flower and in some cases having vigorous young shoots it is obvious that they could not have been collected at 10,000 feet and over in April and early May. The sheets are much mixed and although they bear Thomson's manuscript labels giving the dates of collection, the specimens on one sheet were possibly not all collected on the same day. The earliest sheet bears the date April 1848, during which time Thomson travelled from Ikardo to Srinagar, and as there is no mention of *Astragalus* in his journal for this month there is no clue to the exact place of collection. The specimens on this sheet are (a & b) *A. Daltonianus* Bunge, (c & d) *A. psilocentros*, Fisch. The next sheet is dated 2nd May 1848 and came from between Srinagar and Pampur. The elevation of Srinagar is about 5250 feet and Pampur not much more. Of the specimens on this sheet a, b, and d are *A. Daltonianus*, Bunge. The next sheet is dated 10th May 1848 and Thomson's specimens came from the Banahal Valley at about 4000–5000 feet. On this sheet specimen (a) is *A. psilocentros*, Fisch. and the label showing that one of the specimens was collected by Flemming in the Salt Range or Murree hills doubtless refers to it. The remaining specimens are *A. Daltonianus*, Bunge. The last sheet is dated 12th May 1848 on which date Thomson was at Nasmon on the Chenab, the elevation of which Thomson states in his journal to be 2700 feet (p. 303). The specimens on this sheet are a, b, and d, *A. Daltonianus*, Bunge, c, *A. psilocentros*, Fisch. A sheet of Thomson's in Herb. Bentham gives the elevation at which *A. Daltonianus*, Bunge, occurs as 5500–7000 feet, which may be accepted as correct as it agrees with the heights at which other collectors have found this plant. Bunge appears to have been misled by a specimen of *A. psilocentros*, Fisch. as he states that the stipules are connate on young shoots in *A. Daltonianus*. The markedly panduriform standard with acutely angled basal lobes which Bunge mentions as a character of *A. Daltonianus* I find to be inconstant and it passes gradually into the form of standard found in *A. cicerifolius*, Royle ex Fischer with which it should be united.

A. psilocentros, Bunge, is Fischer's plant.

A. cicerifolius, Royle ex Bunge. It is not known what plant Royle called *A. cicerifolius*. As neither Bunge nor

Fischer saw an original of Royle's, there is no particular reason for supposing that Bunge is correct and Fischer not. Bunge accepts Thomson's specimens as being correctly named *A. cicerifolius*, Royle, and Fischer accepts Jacquemont's. It is not improbable that Royle named more than one plant *A. cicerifolius*, and as Fischer was the first to take up Royle's herbarium name, Bunge's name cannot be retained. The type of *A. cicerifolius*, Royle ex Bunge, is Thomson's plant from West Tibet, 10,000–14,000 feet. There are 3 sheets of this in Herb. Kew. The first was collected on 21st August 1847 at or near Sugnum in Upper Kunawar. The sheet is mixed, a, b, and c, are *A. cicerifolius*, Royle ex Bunge = *A. oplites*, Benth. mss., d and e are small scraps which are probably *A. polyacanthus*, Royle and *A. Jacquemontii*, Bunge. The second sheet was collected at Le in Ladakh in July 1848 and shows two specimens of *A. oplites*, Benth. The third sheet is mixed and it is not possible to say for certain to which specimens the various labels belong. Specimens a, b and c, are *A. cicerifolius*, Royle ex Fischer, d, is *A. oplites*, Benth., and e, *A. polyacanthus*, Royle (probably), but the specimen is very poor. If they came from Kashmir, Nubra and Ladakh, respectively it would agree with the known distribution of these species, though the arrangement of the labels on the sheet does not suggest these localities. There is also a sheet of Thomson's showing three pieces of *A. oplites*, Benth., in the Calcutta herbarium. They were gathered in Nubra on 2nd September, 1848.

A. tenuispinus, Bunge. The types are Jacquemont's nn. 1543 and 1584. According to Bunge these came from Kashmir and Kunawar. Both are *A. polyacanthus*, Royle; n. 1543 came from between Kanum and Sugnum in Kunawar and n. 1584 I suspect from Lari in Spiti or from Kunawar. Jacquemont calls the plant *A. microphyllus*, and mentions it in his journal (Journ. ii. 259, 345, 372, 405 and 414), for Kunawar and Spiti.

A. scariosus, Benth. ex Bunge, founded on Jacquemont's n. 1143 and sheets of Thomson's, is *A. cicerifolius*, Royle ex Fisch.

As Baker l.c. quotes the synonyms fully it is only necessary to point out that *A. polyacanthus*, Baker, is not Royle's plant. *A. multiceps*, Baker is Wallich's plant, not Royle's. *A. leptocentrus*, Baker, is Bunge's plant only as regards part of Thomson's sheet from between Hango and Lio in Upper Kunawar. With this are mounted two scraps of some other species, possibly *A. zanskarensis*, Benth., from Kargil, Dras. Winterbottom's specimen from Astor (*i.e.*, Hassora not Hazara) is also not *A. leptocentrus*, Bunge. These specimens have much the appearance of a silky-leaved form of *A. Candolleanus*, Royle.

The species known to occur in the N. W. Himalaya are as follows :—

A. polyacanthus, Royle ex Benth. in Royle, l.c. 199, non Baker. *A. psilacanthus*, Fisch. l.c. 407 quoad pl. Jacq. *A. tenuispinus*, Bunge, l.c. xi. 44, xv. 70. *A. microphyllus*, Jacq. Journ. ii. 259.

Kunawar, Ladakh 9–15,000 feet.

A. cicerifolius, Royle ex Fisch. l.c. 404, non Bunge nec Baker. *A. scariosus*, Benth. ex Bunge l.c. xi. 44, xv. 71. *A. Daltonianus*, Bunge l.c. xi. 44, xv. 7.

Chitral, Gilgit, Yarkand, Baltistan, Hazara, Kashmir, Chamba and Kunawar, 4000–8000 feet.

A. psilocentros, Fisch. l.c. 405. *A. polyacanthus*, Baker l.c. 134 ex parte, non Royle. *A. polemius*, Boiss. l.c. 306.

Baluchistan, Waziristan, Kurram, Salt Range.

Var. **pilosus,** *mihi*. *A. polyacanthus*, Benth. var. *pilosus*, Benth. mss.

Murree Hills, Kashmir, Garhwal, 3000–7000 feet.

A. bicuspis, Fisch. l.c. 406.

Gilgit, Astor, Baltistan, Chamba, and British Lahaul, Kunawar, 8,000–11,000 feet.

A. zanskarensis, Benth. ex Bunge, l.c. xi. 43, xv. 67.

Zanskar, 10,000–14,000 feet.

A. Jacquemontii, Bunge, l.c. xi. 44, xv. 68. *A. Grahamianus*, Fisch. l.c. 406, quoad pl. Jacq. *A. multiceps*, Royle non Wall. *A. leptocentrus*, Bunge. *A. leptocentrus*, Baker, l.c. 135 ex parte.

Kunawar 9000–10,000 feet.

A. oplites, Benth. *A. cicerifolius*, Royle ex Bunge, non ex Fischer.

Yarkand, Nubra, Ladakh, Pangi, Lahaul, Spiti, Kunawar, 12,000–16,000 feet.

XXXIII.—A REVISION OF THE GENUS BELOTIA.

T. A. Sprague.

The incomplete state of our knowledge of the Central American forest flora is well illustrated by the genus *Belotia* (*Tiliaceae*). Up till recently only two species were generally recognized, *B. mexicana*, of which *B. grewiaefolia* was assumed to be a synonym, and *B. insignis*. In 1914 two more were described : *B. panamensis*, Pittier, from Panama, and *B. Lessertiana*, Hochr., from Cuba. By the separation of *B. grewiaefolia*, and the description of six new species, the number is now raised to eleven, and it is probable that others remain to be discovered. The known area of the genus stretches from the Mexican States of Vera Cruz and Guerreo to Panama, Cuba and St. Lucia. It may be found to extend into South America when the Pacific Coast forests of Colombia have been more fully explored.

The history of *Belotia* commences in 1824 with the description of *Grewia mexicana*, DC., a Mexican species doubtfully assigned

to *Grewia* in the absence of fruit.* In 1845 Achille Richard founded the genus *Belotia* on a single species, *B. grewiaefolia*, collected by Valenzuela in Cuba.† Richard cited *Grewia mexicana*, DC., which he does not appear to have seen, as a synonym of *B. grewiaefolia*, on the strength of De Candolle's description. His remarks are as follows :—" La plante que nous venons de décrire nous paraît être la même que l'espèce de M. de Candolle, autant du moins qu'il nous a été permis d'en juger, par le caractère peu détaillé que ce savant a donné de son espèce; et en effet notre plante de Cuba a bien le port et les caractères extérieurs d'un *Grewia*; mais l'analyse que nous avons faite de sa fleur et particulièrement celle de l'ovaire nous ont fait découvrir dans notre plante des différences qui la distinguent immédiatement du genre *Grewia*." As will be seen from the key, and the remarks under *Belotia mexicana* and *B. grewiaefolia*, these two species differ in the shape, texture, indumentum and marginal teeth of the leaves, the inflorescence and the size of the flowers.

The principal diagnostic characters of *Belotia* are the presence of nectaries at the base of the petals, and their absence on the androgynophore; the blue or violet, rarely white petals; the bilocular ovary with pluriovulate loculi; the loculicidal capsule, strongly compressed transversely to the septum; and the discoid ciliate seeds. In all these respects *Belotia* resembles the Old-World genus *Trichospermum*, which differs in having a pair of nectaries at the base of the lamina, and a pseudo-umbellate inflorescence. As King pointed out,‡ the descriptions of *Trichospermum* published by previous authors were very inaccurate, with the result that it was assigned by Bentham and Schumann to the tribe *Tilieae*, instead of being placed by the side of *Belotia* in the *Grewieae*. In Hochreutiner's revised classification of the *Tiliaceae*, however, both genera are correctly referred to the *Grewioideae-Grewieae*.§

Misled by A. Richard's reduction of *Grewia mexicana* to *Belotia grewiaefolia*, Turczaninov re-described *G. mexicana* as a supposed new species, *Belotia Galeottii*, from specimens collected by Galeotti (No. 4621) in Vera Cruz. Hemsley suggested that *Grewia mexicana* and *Belotia Galeottii* were conspecific, and Hochreutiner united them, but neither they nor any other authors seem to have suspected that Richard's identification of the Cuban *Belotia grewiaefolia* with the Mexican *Grewia mexicana* was erroneous.

Further confusion was introduced by Bentham's reduction of *Adenodiscus*, Turcz., to *Belotia*,‖ which was accepted by Hemsley and Schumann. Turczaninov founded the new genus and species,

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* DC. Prodr. i. p. 510 (1824).
† La Sagra, His. Ile Cuba, Bot. i. p. 207 (1845), Atlas t. 21 (1853).
‡ Mat. Fl. Mal. Penins. i. p. 228 (1891).
§ Ann. Conserv. et Jard. Bot. Genève, xviii.–xix. p. 80 (1914).
‖ Benth. et Hook. f. Gen. Pl. i. p. 233 (1862).

Adenodiscus mexicanus, on *Galeotti* 4154 from Vera Cruz, and described it as having yellow flowers, eglandular petals, five antepetalous glands on the androgynophore, and leaves with glanduliferous basal serratures. These characters, which are inconsistent with *Belotia*, suggested to the writer that *Adenodiscus mexicanus* might be a species of *Heliocarpus*, in spite of the fact that the ovules were described as numerous; and a search in the Kew Herbarium resulted in the discovery of a duplicate of the type number, which agrees with Turczaninov's description except that the ovules are only two in each loculus. It is a very distinct species of *Heliocarpus*, with leaves which are unusually glabrous for the genus, but have tufts of hairs in the axils of the veins on the lower surface. This character is mentioned by Turczaninov, and also by Hochreutiner, who redescribed another duplicate of the type number as a supposed new species, *Heliocarpus glabrescens*.* It should now bear the name *Heliocarpus mexicanus* (Turcz.) Sprague, comb. nov.

It may be useful to mention some of the chief characters which serve to distinguish the various species of *Belotia*. Perhaps the most important is the nature of the indumentum on the leaves, as is often the case in the *Tiliaceae*. In some species, such as *B. mexicana*, all the hairs are in one tier, whilst in others, such as *B. Campbellii*, there is a lower tier of relatively small and crowded hairs, and an upper of larger and more distinct ones. The veinlets are finely but strongly reticulate on the upper surface in *B. reticulata* and, to a less extent, in *B. grewiaefolia* and *B. Lessertiana*. The shape and direction of the marginal teeth also afford useful characters. There is considerable diversity in the inflorescence: *B. panamensis* is unique in its 1–3-flowered cymes; *B. grewiaefolia* has a small, relatively compact inflorescence; and *B. tabascana* is easily recognized by its small inflorescences in the axils of foliaceous bracts on axillary short-shoots. The size of the flowers and the general shape of the petals are relatively constant, but the apex of the petals may vary in certain species, even in the same flower, some petals being distinctly bifid and others irregularly toothed or subentire. The shape and size of the capsule is of great importance.

Belotia, *A. Rich.* in La Sagra, Hist. Ile Cuba, Bot. i. p. 207 (1845), Atlas t. 21 (1853); Benth. in Benth. et Hook. f. Gen. Pl. i. p. 233 (1862) excl. syn. *Adenodiscus*, Turcz.; K. Schum. in Engl. et Prantl., Nat. Pflanzenf. iii. 6, p. 28 (1890), excl. syn.

Flores pentameri. *Sepala* exappendiculata. *Petala* ligularia vel oblongo-spathulata, apice plus minusve bifida vel dentata, basi intus area ciliata nectarifera instructa, caerulea vel violacea, rarius alba. *Androgynophorum* nudum, apice discum late ciliatum gerens. *Stamina* numerosa, libera; antherae suborbiculares. *Ovarium* biloculare; loculi pluriovulati; ovula biseriata. *Capsula* bilocularis, septo contrarie valde compressa, loculicida. *Semina*

* Ann. Conserv. et Jard. Bot. Genève, xviii.–xix. p. 122 (1914).

discoidea, longe ciliata. *Arbores* mediocri vel magni, foliis indivisis, serrulatis vel denticulatis saepissime acuminatis, inflorescentia cymosa saepius thyrsoidea.

Species adhuc cognitae 11, Mexici, Americae centralis, Panamae, Cubae et Sanctae Luciae incolae. Typus, *B. grewiaefolia*, A. Rich.

Key to the Species.

Cymes 1–3-flowered; sepals 7·5-8 mm. long; capsule 1·4 cm. long, 2 cm. broad - - 5. *panamensis.*

Cymes many-flowered:

Leaves acute or very shortly acuminate, nearly concolorous, pubescent above, coarsely pubescent or tomentose beneath; sepals about 1·2 cm. long; capsule transversely elliptic, slightly retuse, 1·8 cm. long, 2·8 cm. broad - 1. *insignis.*

Leaves rather long acuminate:

Leaves very thin, subconcolorous, sparingly pubescent beneath; capsule obovate-deltoid, slightly retuse or subtruncate, 1–1·1 cm. long, 1·3–1·4 cm. broad - - - - - 8. *grewiaefolia.*

Leaves firmly chartaceous or subcoriaceous, discolorous, tomentose tomentellous or densely pubescent beneath:

Leaves very finely and smoothly tomentellous beneath, hairs in a single tier:

Leaves denticulate, teeth ascending; upper surface glabrescent, minutely and strongly reticulate; nerves on lower surface pubescent with large scattered hairs - - 9. *reticulata.*

Leaves minutely serrulate, teeth appressed; upper surface minutely pubescent, not strongly reticulate; nerves on lower surface finely and densely pubescent or tomentellous 4. *mexicana.*

Leaves coarsely pubescent or tomentose beneath, or tomentellous, with a tier of much larger hairs above the basal indumentum:

Sepals 10·5–12·5 mm. long:

Leaves oblong-lanceolate obtuse at the base, denticulate; upper part of petals glabrous inside - 2. *macrantha.*

Leaves ovate-lanceolate, rounded or subcordate at the base serrulate; upper part of petals pilose on both surfaces - - - - 3. *grandiflora.*

Sepals 5–7 mm. long:

Leaves densely tomentose beneath; branchlets ferrugineous-tomentose:

Leaves elliptic, minutely and distantly denticulate, glabrous or subglabrous above, minutely and strongly reticulate 7. *Lessertiana.*

Leaves oblong-lanceolate, rather closely denticulate, at first minutely and densely pubescent above, finally subglabrate, not reticulate - - 6. *caribaea.*

Leaves not densely tomentose beneath; branchlets not ferrugineous-tomentose:

Inflorescences on long-shoots, in the axils of adult or nearly adult foliage leaves; petals ligulate - - - - 10. *Campbellii.*

Inflorescences on axillary short-shoots in the axils of very young foliage-leaves (or foliaceous bracts); petals oblong spathulate - - - - 11. *tabascana.*

1. **B. insignis,** *Baill.* in Adansonia, x. p. 182 (1872); Hemsl. Biol. Centr.-Amer., Bot. i. p. 137 (1879).

Mexico. Guerrero: near Acapulco, *Palmer* 146. Temperate Andes of Mexico, *Ghiesbreght* 356 (ex *Baill.* l.c.).

Differs from all other known species of *Belotia* by the leaves, which are merely acute or at the most very shortly acuminate, and the large size of the flowers and capsules. According to Baillon, *B. insignis* is a lofty tree with violet flowers.

2. **B. macrantha,** *Sprague*, sp. nov.

Arbor 6–9 m. alta. *Ramuli* juniores velutini vel dense pubescentes, mox glabrescentes, elevato-reticulati; internodia 2–3 cm. longa. *Folia* oblongo-lanceolata, longe acuminata, basi obtusa, 13–17·5 cm. longa, 4·5–6 cm. lata, acumine 0·8–3 cm. longo, glandulari-denticulata, denticulis ascendentibus 1·5–5 mm. distantibus, firme chartacea, valde discolora, supra exsiccando brunnea, minute sparse pubescentia vel puberula, subtus indumento griseo duplici, inferiore minute tomentello, superiore grosse pubescente; petioli velutini, 1–1·5 cm. longi. *Thyrsi* axillares, aphylli, 4–6 cm. longi, vel foliaceo-bracteati, usque ad 10 cm. longi. *Alabastra* circiter 1 cm. longa. *Sepala* rubella, 10·5–12·5 mm. longa, 2·75–3·25 mm. lata. *Petala* pallide

caerulea, oblanceolato-ligularia, apice saepius plus minusve bidentata, 1–1·1 cm. longa, 2·25–2·75 mm. lata (parte superiore intus glabra.) *Stylus* 3–3·5 mm. longus, infra medium dense stellato-pilosus. *Capsula* ignota.—*Belotia* n. 4, Hemsl. Biol. Centr.-Amer., Bot. i. p. 137 (1879).

Panama. On slopes of wooded hills at Paraiso railway-station, fl. Dec., *Sutton Hayes* 438 (Herb. Kew et Mus. Brit.).

Allied to *B. mexicana*, to which Hemsley (l.c.) was inclined to refer it. It may be distinguished by the denticulate leaves, the less conspicuous transverse nerves on the upper surface, the indumentum and the larger flowers. According to Sutton Hayes it is a tree 20–30 ft. high, with reddish calyx and pale blue petals.

3. **B. grandifolia,** *Sprague*, sp. nov.

Ramuli juniores fulvo-tomentelli et pilis majoribus grosse pubescentes; internodia 2·5–3 cm. longa. *Folia* ovato-lanceolata, longe acuminata, basi rotundata vel subcordata, 17·5–20 cm. longa, 8–9·5 cm. lata, acumine ut videtur circiter 1·5 cm. longo, glandulari-serrulata, denticulis appressis 1·5–5 mm. distantibus, firme chartacea, discolora, supra exsiccando vix brunnescentia, minute puberula vel glabrescentia, subtus indumento duplici, inferiore minute tomentello, superiore pubescente, nervis longe patenter pilosis; petioli 1·5 cm. longi, pariter ut ramuli induti. *Thyrsi* in axillis foliorum superiorum orti, superiores aphylli, 3–6 cm. longi, inferiores foliati, usque ad 15 cm. longi. *Alabastra* circiter 1 cm. longa. *Sepala* 1·2–1·25 cm. longa, 2·75–3 mm. lata. *Petala* ligularia, apice bidentata, 10·5 mm. longa, 1·25 mm. lata, utrinque pilosula, area basali nectarifera obreniforme.

Mexico. Vera Cruz: Zacuapan; on sunny hills, 1200 m., fl. Aug.–Sept., *C. A. Purpus* 1916 (Mus. Brit.).

Nearly related *to B. macrantha*, from which it differs by the characters indicated in the key, and in the inversely reniform nectaries.

4. **B. mexicana,** *K. Schum.* in Engl. et. Prantl, Nat. Pflanzenf. iii. 6, p. 28 (1890), excl. syn. *B. grewiaefolia*; Hochr. in Ann. Conserv. et Jard. Bot. Genève, xviii.–xix. p. 90 (1914, excl. *B. grewiaefolia.*

Grewia mexicana, DC. Prodr. i. p. 510 (1824).

Belotia Galeottii, Turcz. in Bull. Soc. Nat. Mosc. xix. 2, p. 504 (1846); Hemsl. Biol. Centr.-Amer., Bot. i. p. 137 (1879), excl. stirp. nicarag.

B. grewiaefolia, Hemsl. l.c. 136, excl. stirp. cubens. et syn. *Adenodiscus mexicanus*: non. A. Rich.

Mexico. Vera Cruz: in ravines at 900 m., *Galeotti* 4261. Jalapa, *Galeotti*. Sierra San Pedro Nolasco, Talea, etc., *Jurgensen* 772. Montecinos, *Linden* 43. Between Vera Cruz and Orizaba, *Fr. Muller* 2231. Without precise locality, *Harris*.

As suggested by Hemsley (l.c.) and confirmed by Hochreutiner (l.c.), *B. mexicana* and *B. Galeottii* are conspecific. *B. grewiaefolia*, A. Rich., however, which has been identified with *B. mexi-*

cana by A. Richard, Bentham (Gen. Pl. i. p. 234), K. Schumann, Hemsley and Hochreutiner, differs in the shape, texture, denticulation and indumentum of the leaves, the compact inflorescence and the smaller flowers. It appears to be confined to Cuba.

Adenodiscus mexicanus, Turcz., which was reduced by Bentham and Hemsley to *Belotia grewiaefolia*, A. Rich., is *Heliocarpus mexicanus*, Sprague (*H. glabrescens*, Hochr.).

According to Galeotti (n. 4261), *Belotia mexicana* is a tree 50–60 ft. high, with pale violet flowers. Linden (n. 43) described the flowers as lilac.

5. **B. panamensis,** *Pittier* in Fedde, Repert. xiii. p. 313 (1914).

Panama. Canal Zone, *Pittier* 2584; *Maxon* 4736 (ex *Pittier*). Southern Darien, *Williams* 772 (ex *Pittier*).

According to Pittier, *B. panamensis* is a tree 13–33 ft. high, with purple flowers. It is evidently related to *B. macrantha*, but has few-flowered inflorescences and smaller flowers.

6. **B. caribaea,** *Sprague*, sp. nov.

Ramuli dense ferrugineo-tomentosi. *Folia* lanceolata, longe acuminata, basi obtusa vel rotundata, 10·5–16 cm. longa, 3–5·7 cm. lata, acumine 1·5–2 cm. longo, denticulato-serrulata, denticulis ascendentibus 1·5–3·5 mm. distantibus, firme chartacea, valde discolora, supra exsiccando brunnea minute dense pubescentia, tandem glabrescentia, subtus dense tomentosa; petioli 1–1·4 cm. longi. *Thyrsi* plures, 2·5–5 cm. longi, paniculam terminalem efficientes. *Sepala* 6 mm. longa, 1·75 mm. lata. *Petala* oblanceolato-ligularia vel spathulato-ligularia, apice bidentata, 5·5–7 mm. longa, 1–1·2 mm. lata. *Capsula* transverse elliptica, apice subtruncata, 1 cm. longa, 1·2 cm lata.

West Indies. St. Lucia, *Anderson*.

An unlocalized specimen from *herb. Miller* (Mus. Brit.) also belongs to this species. It is described in the Solander MSS. under a manuscript name not reproduced here.

Related to *B. mexicana*, from which it may be separated by the indumentum, the denticulation of the leaves and the smaller flowers.

7. **B. Lessertiana,** *Hochr.* in Ann. Conserv. et Jard. Bot. Genève, xviii–xix. p. 90 (1914).

Cuba. Havana, *Delessert* (ex *Hochr.* l.c.).

Apparently allied to *B. grewiaefolia*, from which it may be distinguished by the minutely and distantly denticulate leaves, densely tomentose on the lower surface.

8. **B. grewiaefolia,** *A. Rich.* in La Sagra, Hist. Ile Cuba, Bot. i. p. 209 (1845), Atlas t. 21 (1853), excl. syn.; Griseb. Cat. Pl. Cub. p. 30, n. 8 (1866), excl. syn.; Sauvalle, Fl. Cub. p. 15, n. 248 (1873).

Vernacular Names. Majagua macho, Majagüilla macho, Guacimilla.

Cuba. Vuelta de Abajo, in clayey soil, *Valenzuela* (ex *A. Rich.* l.c.). Without precise locality, *C. Wright* 2090 (Herb. Kew. et Mus. Brit.).

The salient characteristics of *B. grewiaefolia* are the very thin leaves, glabrescent and minutely reticulate on the upper surface, minutely and sparingly pubescent on the lower, the small flowers, and the short compact terminal inflorescence. Wright's no. 2090 agrees with Richard's description and figure except that the leaves are more closely denticulate.

According to A. Richard, *B. grewiaefolia* is a fairly tall tree with white flowers.

9. **B. reticulata,** *Sprague*, sp. nov.

Ramuli juniores breviter ferrugineo-tomentosi. *Folia* ovato-lanceolata vel lanceolata, longiuscule acuminata, basi inaequaliter obtusa vel rotundata, 9·5–16·5 cm. longa, 3–7 cm. lata, acumine 1–1·5 cm. longo, denticulato-serrulata, dentibus ascendentibus 1·5–4 mm. distantibus, firme chartacea, supra juventute minute sparse pubescentia, mox puberula vel glabriuscula, minute valde reticulata, subtus subfulvo-tomentella, nervis conspicue prominentibus pilis majoribus sparsiuscule pubescentibus; petioli 1–2 cm. longi. *Alabastra* juvenilia tantum visa. *Petala* ut videtur ligularia. *Capsula* transverse elliptica, valde retusa, 1·6–1·7 longa, 2–2·1 cm. lata.—*B. Galeottii*, Hemsl. Biol. Centr.-Amer., Bot. i. p. 137 (1879), partim; Goyena, Fl. Nicarag. p. 206 (1911); non Turcz.

NICARAGUA. Chontales, *Seemann* 11 (type), 12 (Herb. Kew. et Mus. Brit.).

Apparently most nearly allied to *B. Campbellii*, from which it differs in the indumentum of the leaves and the much larger, strongly retuse capsules.

10. **B. Campbellii,** *Sprague*, sp. nov.

Arbor. *Ramuli* dense pubescentes, tandem longitudinaliter rugosi; internodia 1·5–4 cm. longa. *Folia* ovato-lanceolata, longe acuminata, basi rotundata vel obtusa, 11–18 cm. longa, 4–7·5 cm. lata, acumine 1–2 cm. longo, denticulato-serrulata, dentibus ascendentibus 1·5–4 mm. distantibus, firme chartacea, valde discolora, supra exsiccando brunnescentia, sparse pubescentia vel puberula, tandem minute subtiliter reticulata, subtus indumento duplici, inferiore minute tomentello vel dense pubescente, superiore grosse pubescente; petioli velutini, 1–1·5 cm. longi. *Thyrsi* 2–4 cm. longi in axillis foliorum superiorum et bractearum foliacearum, inflorescentiam circiter 10 cm. longam efficientes. *Sepala* 6·5–7 mm. longa, 1·75–2 mm. lata. *Petala* ligularia, superne paullulo ampliata, apice bifida, 6–7 mm. longa, 1–1·2 mm. lata. *Capsula* transverse elliptica, leviter retusa vel subtruncata, vix 1 cm. longa, 1·3 cm. lata.

VERNACULAR NAMES. Moho, Balsa.

BRITISH HONDURAS. Seven Hills Estate, *Campbell* 75 (type). Sibun River, *Campbell* 81. Stann Creek, about 12 miles from Stann Creek town, *Hummel*.

Named after Mr. E. J. F. Campbell, for many years Curator of the Botanic Station, British Honduras, who has from time to

time contributed dried specimens to the Kew Herbarium. According to Mr. C. Hummel, Forestry Officer, British Honduras, the name "Balsa Wood" is applied in British Honduras to the wood of three different trees, namely, "Pollak" (*Ochroma* sp.), "Moho" (*Belotia Campbellii*) and "Quamwood" (*Schizolobium Kellermanii*).

11. **B. tabascana,** *Sprague*, sp. nov.

Ramuli dense pubescentes, demum glabrescentes, longitudinaliter rugulosi; internodia 1·5–2·5 cm. longa. *Folia* ovata vel ovato-oblonga, longiuscule acuminata, basi rotundata vel subtruncata, 6–13·5 cm. longa, 2·5–6·5 cm. lata, acumine 0·5–1 cm. longo, serrulata, denticulis ascendentibus vel subap pressis 1–3 mm. distantibus, firme chartacea, valde discolora, supra exsiccando brunnea, minute asperula pubescentia vel puberula, nervis grossius pilosis, subtus indumento duplici, inferiore griseo minute tomentello, superiore fulvescente grosse pubescente; petioli dense grosse pubescentes, 1–1·5 cm. longi. *Thyrsi* 1–1·5 cm. longi, pluriflori, in axillis foliorum juvenilium (seu bractearum foliacearum) in ramulis axillaribus abbreviatis 2·5–5 cm. longis. *Sepala* 5·5–6·5 mm. longa, 1·5–1·75 mm. lata. *Petala* oblongo-spathulata 5–5·5 mm. longa, 1·3–1·4 mm. lata, subintegra vel apice irregulariter plus minusve biloba. *Capsula* ignota.

Vernacular Name. Palincano.

Mexico. Tabasco: Lomas de San Sebastian; fl. March, *Rovirosa* 416.

A well-marked species, distinguished at the first glance by the thyrses, which are borne in the axils of very young leaves (or foliaceous bracts) on axillary short-shoots. The leaves are relatively short and broad, and are asperulous on the upper surface.

Synonyma excludenda.

Adenodiscus, Turcz. = **Heliocarpus,** *Linn.*

A. mexicanus, Turcz. = **H. mexicanus,** *Sprague* (*H. glabrescens*, Hochr.).

XXXIV.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS.—III.*

Joseph Burtt-Davy.

11. **Indigofera Evansiana,** *Burtt-Davy* [Leguminosae-Galegeae]; *I. Woodii*, Bolus, affinis, sed foliolis angustioribus et non distincte mucronatis differt.

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* The following ten numbers (11–20) were intended for publication with Nos. 1–10, in Part I. (*Kew Bull.* 1921. p. 49), but were accidentally omitted; they are therefore published here as Part III. Part II. appeared in *Kew Bull.* 1921, p. 191.

Caules 12·5–14 cm. alti, foliosi, a basi ramosi, perspicue annui, e collo perenni crescentes. *Folia* circiter 5–8 mm. in caule distantia, 1·8–2 cm. longa, foliola opposita, 8–10-juga, strigosa, 5–6 mm. longa, 1–1·5 mm. lata; stipulae minutae, subulatae, recurvatae. *Pedunculi* 2–3 cm. longi; pedicelli circiter 3 mm. longi. *Calycis* lobi subulati. *Legumina* numerosa (5–8), terminalia, 1·2–1·8 cm. longa, 2–2·5 mm. lata, sparse appresso-strigosa, rostrata.

South Africa. Transvaal: Wakkerstroom Distr.; Amersfoort, circa 1700 m., Mch. 15, 1917 (in fruit), *Burtt-Davy* 17345 *in herb. Bolus.*

Named in memory of the late Maurice S. Evans of Natal, who collected and described several new plant-species, and who collaborated with the late Dr. J. Medley Wood, A.L.S., in the publication of *Natal Plants.*

12. **Combretum Millerianum,** *Burtt-Davy* [Combretaceae]; *C. Buchanani*, Engl. & Diels, *C. gazensi*, Bak. f., et *C. suluense*, Engl. & Diels, affine.

Arbor. Folia ramulorum juvenilium opposita vel subopposita; petioli 1·3 cm. longi, robusti, puberulentes; laminae foliorum 12·7–18 cm. longae, 7·5–10 cm. latae, oblongae, obtusae vel aliquanto apiculatae, ad basim truncatae vel rotundatae, in pagina superiore brunneo-virides et glabrae, in inferiore autem pallidae, in axillibus nervorum pubescentes, alibi sparse lepidotae, nervis supra leviter impressis infra prominentibus. *Flores* non vidi. *Fructus* rubro-fusci, 4 cm. longi, 2·5–3 cm. lati, 4-alati, alis circiter 1 cm. latis; pedicelli 3 mm longi.

South Africa. Swaziland: Lubombo Flats; between Buckham's and Forbes' Coal-mine, plentiful, June 22, 1911 (in fruit), *Burtt-Davy* 10681 *in herb. Bolus.*

This species belongs to the Section *Glabripetalae* of Engler and Diels; it is named after Mr. Allister M. Miller, the Swaziland pioneer and enthusiast.

13. **Tarenna**(?) **papyracea,** *Burtt-Davy* [Rubiaceae-Gardenieae]; *T. tetramerae*, Hiern, et *T. grandiflorae*, Hiern, affinis, sed foliis amplis papyraceis (fere translucidis) penninerviis distinguitur.

Arbor parva, ramuli juveniles pubescentes. *Folia* ampla, papyracea (fere translucida), subsessilia; petioli 3 mm. longi, pubescentes; laminae 14–18 cm. longae, 5–5·7 cm. latae, oblongae, acutae, vel aliquanto acuminatae, in petiolum gradatim acuminatae, sparse punctatae et supra (praecipue in nervis) pilis patentibus pilosae, infra in costa prominente hirsutae; nervi secondarii hirsuti aliquanto prominentes, tenues, penninervii, 6–9 mm. inter se distant; nervi angulo 90 costa reserti. *Flores* non vidi.

South Africa. Transvaal: Pietersburg Distr.; Houtboschberg forests, *Burtt-Davy* 5091, *in herb .Bolus.*

14. **Allophylus transvaalensis**, *Burtt-Davy* [Sapindaceae-Sapindeae]; *A. melanocarpo*, Arn., affinis, fructibus autem majoribus (5–6 mm. longis) et rubris, petiolis et partibus juvenilibus dense tomentosis differt.

Arbor parva vel frutex, novellis hirsutis, pilis longis et patentibus. *Foliola* supra sparse, et praecipue in costa, pilis erectis setosis setigera. *Racemi* non saepe ramosi.

South Africa. Transvaal: Pietersburg Distr.; Houtbosch, *Rehmann* 5567 *in herb. Kew.* (type); Modjadjies Mt., in Mrs. Eland's "Bush," 1250–1280 m., native name "Musunquani Soadi," *Burtt-Davy* 2678 *in herb. Bolus*; Swiss Mission Sanatorium near Shilouvane, in the forest, shrub about 3 m. high, *Junod* 1421.

Dr. Szyszylowicz (*Plantae Rehmannianae*) doubtfully refers *Rehmann's* 5566 to *Schmidelia magica*, Baker, but does not mention his 5567.

15. **Allophylus Sprageanus**, *Burtt-Davy* [Sapindaceae-Sapindeae]; *A. melanocarpo*, Arn. et *A. transvaalensi*, Burtt-Davy, affinis, foliolis terminalibus late ovatis apicem versus acute dentatis, pilis non in axillis costae et nervorum aggregatis differt.

Arbor parva, 8–10 m. alta. *Folia* nec setigera nec tomentosa, sed molliter pilis porrectis pubescentia. *Foliola* supra pilis sparsis vestita, apicem versus acute et grosse dentata, basi integra et cuneata, terminale late-ovatum, 6 cm. longum, 4 cm. latum.

South Africa. S. Rhodesia: Victoria Falls; damp ground, *C. E. F. Allen* 143 *in herb. Kew.*

16. **Adenia angustisecta** *Burtt-Davy* [Passifloraceae-Modeccae]; species foliorum lobis angustissimis longisque facile distincta.

Herba scandens (?). *Caules* succulentes (?), sicci 6 mm. lati, annui (?) e collo perenni crescentes. *Rami* breves, cirris brevibus gracilibusque. *Folia* 5-palmatisecta, glabra, petiolis 3–5 mm. longis glandibus duobus magnis ad apicem munita, stipulis subulatis deciduis. *Foliorum* lobi anguste lineares, ad 8·5 cm. longi et 1–3 mm. lati, plicati. *Flores* ♀ pedunculati, languide purpurascentes; ♂ non vidi. *Calyx* 8 mm. longus, tubo circiter 4 mm. longo, lobis 4 mm. longis et 2 mm. latis. *Petala* circiter 4 mm. longa.

South Africa. Transvaal: Lydenburg Distr.; Ohrigstad Valley, Oct. 23, 1908, *H. G. Mundy in T. D. A. Herb. No.* 4700 *in herb. Bolus.*

The specimen is obviously a young spring shoot, and the leaves are, perhaps, not fully developed. The tendrils appear inadequate to support the weight of the plant, and from the scrappy material available (a shoot about 2 dm. high), it is not evident that the plant climbs. The stipules are well-developed for the genus.

17. **Cynodon transvaalensis,** *Burtt-Davy* [Gramineae-Chlorideae]; species bene distincta, a *C. Dactylone,* Pers, habitu teneriore flaccidiore densiore caespitoso, colore viridi nec glauco, spicis binatis brevioribus ad basim nudis, glumis brevioribus majoribus acuminatis, et valva dorso minus ciliata, imprimis differt.

Herba perennis, repens, densissime caespitosa. *Culmi* tenuissimi. *Folia* brevia, viridia (nec glauca), flaccida, acutissima nec pungentia, sparse pilosa, ad os vaginae barbata, 1·2–5 cm. longa vel longiora, ad 1·5 mm. lata, vaginibus saepe purpurascentibus glabrisque. *Pedunculi* tenuissimi. Spicae digitatae, binatae, 1–2 cm. longae, ad basim nudae. Spiculae 2·5 mm. longae; rhachilla prolongata, tenuis. *Glumae* subaequales, 1 mm. longae, carina glabra. *Valva* ad apicem sparse ciliata vel glabra.

South Africa. Transvaal: Vereeniging Distr.; Burttholm (Uitgevallen 197), *Burtt-Davy* 18156 (type) *in herb. Kew.*; Ermelo Distr., Lake Chrissie, *Burtt-Davy*; Witwatersrand Distr., Germiston, *Burtt-Davy,* and elsewhere along the Reef. Usually growing in moist, open places subject to flooding in the rainy season, on the margins of pans and dams.

A strikingly distinct species, which I named provisionally some years ago, but did not publish as it was desirable to compare it with authentic material of *C. pascuus*, Nees; this has now been done and my plant proves to be quite different from the latter, which appears to be only a form of *C. Dactylon*, Pers. I have had *C. transvaalensis* under cultivation for many years, under precisely similar conditions of soil, moisture, exposure, etc., and alongside of, both *C. Dactylon,* Pers., and *C. incompletus,* Nees; it retains its characters without showing any tendency to vary in the direction of either species. Transplanted from the damp sandy soil of a dam margin to a harder and drier soil, it also retains its characters. The distachyous inflorescence is found in luxuriant forms, as well as in those less well-grown, and is therefore not attributable to starvation nor to xerophytic conditions, as is the case with starved forms of *C. Dactylon,* Pers. (*e.g.*, from Uitenhage, *Zeyher* 446, Claremont Flats, *Schlechter* 151, and Somerset East, *MacOwan* 2119 all *in herb. Mus. Brit.*). In habit and foliage *C. transvaalensis* is not unlike the Australian *C. tenellus*, R. Br., but differs in the inflorescence.

Two Australian specimens of *C. Dactylon*, Pers. at Kew (from "Murray," *F. von Mueller* and "Victoria," *Robertson* 581) bear some resemblance to *C. transvaalensis*, but differ in the more robust habit, more hairy sheaths, apparently more rigid leaves, spikelets more imbricate and clothing the spikes to the base, longer glumes, and more ciliate valves. The first cited bore the MSS. name *C. Dactylon β distachyus*, F. v. Mueller.

Owing to its rapidly spreading, compact, dense habit of growth and soft springy nature, *Cynodon transvaalensis* is excellent for lawns, bowling greens, etc., for which purposes it is now the principal grass used in the Transvaal, under the names

of "Florida Kweek" or "Florida grass" (after the township of Florida, near Johannesburg) "Germiston Grass," etc. It is a favourite with leaf-cutting Termites, which sometimes give it a rather moth-eaten appearance if not kept properly mown, but it is well worth introduction into warm countries, for lawn purposes.

18. **Convolvulus ornatus,** *Engl.*; Fl. Cap. iv. Sec. 2, p. 76.

South Africa. Transvaal: Bloemhof Distr., farm "Kaffraria" near Christiana, occasional, *Burtt-Davy* 12747, Mch. 1912, and 14031, May 1912; near Schweizer Reneke, *Burtt-Davy*. British Bechuanaland: Vryburg Div., Armoed's Vlakte, Dec. 21, 1911, *Burtt-Davy* 11729; Klipvlakte, *Burtt-Davy* 11127. Orange Free State: Bloemfontein Distr., Bester's Put, *Burtt-Davy* 11774. Also in Griqualand West and the Carnarvon Division of the Cape Province.

An extension of known range. This plant is distinctly characteristic of the Southern Bechuanaland Region, and its occurrence in the Bloemhof District is another interesting connecting link between that Region and the S. W. Transvaal.

19. **Erigeron linifolius,** *Willd.* [Compositae-Astereae]; *E. canadensis*, Tenore Syll. Fl. Neap. 428, non L.; *Conyza ambigua*, DC. Fl. Fr. Suppl. 468; *Erigeron ambiguus*, Sch. Bip. in Webb. & Berth. Phyt. Canar. ii. 208, non Nutt. nec F. Muell.; *E. bonariensis*, Hort. ex Link Enum. Hort. Berol. ii. 323 (non L. ?).

South Africa. Transvaal: Vereeniging Distr., Uitgevallen 197, 1480 m. alt., *Burtt-Davy in herb. Bolus*; Marico Distr., near Zeerust, 1190 m., Nov. 1907, *Burtt-Davy*; Pretoria, *Wilms* 672, *Lansdell* 68; Modderfontein, *Conrath* 379; Rustenburg, 1400 m., *Nation* 270; Potchefstroom, Witbank, Johannesburg, Lydenburg, Volksrust and elsewhere throughout the settled parts of the Province, common as an alien weed of cultivated lands, stubble, waste places, borders of fields, etc. Basutoland: Leribe, 1830–2130 m. alt., *Dieterlen* 339. Cape Province: Bathurst Div., Martindale, 1915, *Salisbury in herb. Cantab.*, "a far more common weed than *E. canadensis* in S. Africa, and in Australia evidently confounded with it in Floras"; Cape Peninsula: near Klein Constantia and Claremont, *Wolley-Dod* 1302, 2050; Burgher Redoubt, Woodstock, April 1920, *Burtt-Davy* 18928 *in herb. Cantab.*

Considered to be a native of Western Asia, but now widely distributed through the Mediterranean Region, the Madeira, Canary, Cape Verde and Azores Isls., the Southern United States, Australia, Ceylon, India and South Africa. Said to have been introduced into Ceylon in 1864, with seeds from St. Petersburg.

It is browsed freely by horses and cattle, but is a troublesome weed, tenacious, rapidly spreading and with a tough deeply penetrating tap-root, not easily eradicated when well established.

20. **Erigeron canadensis,** *L.*; Sowerby, Engl. Bot. t. 2019; Syme, Engl. Bot. t. 773 (both good); *Leptilon canadense* (L.) Britt. & Br., Illustr. Fl. N. Amer. & Canad. iii. 391, fig. 3827 (figure poor and showing a smooth pappus).

South Africa. Without precise locality (probably Caledon River, O. F. S.), *Zeyher* 805 *in herb. Cantab. ex herb. Lemann*, 1852. Transvaal: Vereeniging Distr., Uitgevallen 197, *Burtt-Davy*; Marico Distr., Matebe Valley, *Holub*; Rustenburg, *Nation* 198. Natal: without precise locality, *Cooper* 1267; Inanda, *Wood*. Orange Free State: Caledon River (Wepener Distr.?), Jan. 1841, *Burke*; Harrismith, *Sankey* 101. Cape Province: Somerset East, by streams at 600 m. alt., Mch. 1866, *Bolus* 300; British Caffraria, *Cooper* 37; Bazeia, Kaffraria, "a weed in cultivated lands, 600-750 m. alt." *Baur* 339.

Vernacular Names: Horseweed, Canadian Flea-bane.

Native of N. America where, also, it is described as a "common weed"; now naturalized widely through the Old World. An early introduction into S. Africa, having been collected in the Eastern Province and Natal prior to 1865 by Burke and others.

Sowerby states that the name Fleabane was given to this plant because of "its reputed power, when burned, of destroying fleas. According to M. Losanne, in a paper read to the Agricultural Society of Turin, the bark of this plant, after having undergone the process of soaking, may be made into excellent paper."

There has been a good deal of confusion in herbaria between the Asiatic *E. linifolius*, Willd. and the North American *E. canadensis*, L., as indicated by names and notes on herbarium sheets from Australia, etc. In some cases the specimens of *E. linifolius* have been equally divided between the covers of *E. canadensis*, L., and *Conyza ambigua*, DC. Tenore also appears (Syll. Fl. Neap.) to have misunderstood the species, calling the Mediterranean plant by the name Linnaeus applied to the N. American species. The illustration of *E. canadensis* in Bentham and Hooker's *Handbook to the British Flora* is misleading as is also that in Britton & Brown's *Illustrated Flora of N. America & Canada*.

Both plants are commonly met with in S. Africa, often growing together as weeds of fallow or badly cultivated lands. Of the two, *E. linifolius* is the most plentiful. They are readily distinguishable, when associated, *E. canadensis* being usually taller and greener, with a more distinctly paniculate inflorescence, than *E. linifolius*. The following synopsis indicates the points of difference :—

Branches long, corymbose, often much exceeding the main stem, and flowering after the heads which terminate the latter have shed their fruit; heads fully 3 lines high (*i.e.*, larger than in *E. canadensis*); leaves grey-green, not ciliate, the lower distantly and incisely toothed or laciniate; involucre pubescent; pappus usually white (in herbarium specimens sometimes pinkish, perhaps from the effect of poison?) - - - - - -	1. *E. linifolius*.

Branches short, paniculate (not corymbose), flowering at the same time as the main stem; heads only 1½–2 lines high; leaves yellowish-green (not grey-green), the lower sparingly toothed to quite entire, ciliate with short mostly incurved hairs arising from small tubercles; involucre almost glabrous; pappus usually tawny - - - - - - 2. *E. canadensis*.

E. linifolius has at various times been placed in the genus *Conyza*, with which it and its allies of the Section *Coenotus*, Nutt. (Genus *Leptilon*, Raf.) form a connecting link, by their very short and inconspicuous rays. It was removed from *Conyza* by Bentham & Hooker (Gen. Pl. ii. p. 283).

XXXV.—MISCELLANEOUS NOTES.

Capt. F. Burnett, M.C., B.A., has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, a Divisional Agricultural Officer in the Department of Agriculture, Ceylon.

Mr. D. Prain, Agriculturist, Nyasaland (*K.B.*, 1919, 446) has been appointed by the Secretary of State for the Colonies, Senior District Agricultural Officer in the Tanganyika Territory.

Mr. A. E. Haarer has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, a District Agricultural Officer in the Tanganyika Territory.

Mr. H. A. Dade has been appointed by the Secretary of State for the Colonies, Assistant Mycologist in the Department of Agriculture, Gold Coast.

Mr. J. A. Robotham has been appointed by the Secretary of State for the Colonies, Assistant Agricultural Superintendent, St. Kitts-Nevis.

Botanical Exploration in French West Africa.*—Under the subjoined title Dr. A. Chevalier has published a complete list of botanical specimens gathered during his journeys in the Western Sudan from 1898 to 1912. The chief object of these expeditions was the investigation of the agricultural and forest resources of French West Africa, and for this purpose Dr. Chevalier travelled upwards of 50,000 kilometres, and collected about 10,700 botanical specimens.

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* Aug. Chevalier. Exploration botanique de l'Afrique occidentale française, Tome i., Énumération des Plantes Récoltées, pp. 795, and a vegetation map. (Paris, 1920, 60 fr.)

The enumeration of these, arranged after Bentham & Hooker's Genera Plantarum, occupies a volume of 795 pages. Particulars of habitat, date of collection, vernacular names and short economic notes are given under each species, many of which have been determined at Kew, and are enumerated in the pages of the later parts of the Flora of Tropical Africa. Dr. Chevalier has also had the assistance of several specialists in certain families, and the names of these are mentioned. At the end of the enumeration there is an index to the families, and in addition a large and very interesting map of Upper Guinea, showing the routes followed by the author, the character of the vegetation, and the geographical range of the more important economic plants, which include among others, the rubber producing species of *Apocynaceae*, the Oil and other palms, the Shea-utter tree, and Gum-arabic.

Dr. Chevalier is to be warmly congratulated on this contribution to our knowledge of the vegetation of "Upper Guinea," which, together with the numerous collections we already possess from our own West African Colonies, would provide abundant material for a critical and more comprehensive study of the whole of this part of Tropical Africa. J. H.

The Book of the Mango.*—This work contains chapters on the History, Propagation, Planting, Culture, Marketing, Transport of Trees, Scions and Seeds, Renovation of neglected plantations, Flowering and Pollination, Pests and Diseases, Uses and Canning and Classification of the Mango. In the earlier chapters, especially on history and propagation, Woodrow, Firminger, Watt and Maries in India, Wester (Phillipines), Popenoe (Cuba), Collins (Porto Rico), Macmillan (Ceylon), Higgins (Hawaii), and other well-known writers on the subject have been quoted; but the greater part of the work is, as stated in the preface, the results of original observations and experiments made since 1908 in the Ganeshkhind Botanical Gardens, Kirkee, and in various parts of the Bombay Presidency. This Presidency, from its more favourable situation, seems to have taken a prominent part in popularising the fruit in the markets of this country. Fruits have come into Covent Garden from India and Jamaica at odd times, and only recently, in the "Times Weekly" of May 20th last, an examination at Covent Garden Market is illustrated of a consignment of "Alphonse" Mangoes, which had just reached London from Bombay (by the use of special packing cases) in good condition. Experiments have been made in sending fruits from the Ganeshkhind Gardens to Marseilles, Trieste and London by Mail Steamer (not in cold storage), and the authors express the opinion that, unless fruit can be sent in large quantity and in cold storage, there is no likelihood of developing an overseas trade; they were, however, more hopeful that a trade in canned mangoes may be developed, and apparatus

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* By W. Burns, D.Sc. and S.H. Prayag, M.Ag., pp. I–98, illustrated; (Govt. Central Press; Bombay, 1921). Price Rs. 3–5–0.

has been fitted up at the gardens since 1913 for the purpose of experiment, special mention being made of experiments with the variety "Alphonse," also included with other varieties as having been found to keep well as a fresh fruit.

Woodrow, in his book on the Mango (1904), describes 80 famous mangoes; the present work gives outline figures and descriptions of 89 varieties. J. H. H.

The Silviculture of Indian Trees.*—This comprehensive work comes at a very appropriate moment, for a special effort is being made to interest importers and manufacturers in Indian woods, and such a book cannot fail to impress people with the wealth of trees growing in the forests of India. Professor Troup's long connection with the Indian Forest Service at the Forest Research Institute at Dehra Dun and elsewhere, placed him in a peculiarly advantageous position for studying the subject, whilst his undoubted ability for critical observation and description enabled him to make the most of his opportunities, and he has produced a book which will, without doubt, become classical in its application, although the author regards it simply as a foundation for further effort in the creation of a greater work on Forest Research by future workers. There are three volumes consisting of 1195 pages of descriptive letterpress, in addition to 58 introductory pages and 490 pages of black and white and coloured illustrations. The book is arranged botanically, the first volume carrying the student from *Dilleniaceae* to *Leguminosae* (*Papilionaceae*). Volume II advances the work to *Verbenaceae*, whilst the third volume commences with *Lauraceae* and concludes with *Coniferae* and a good index. In the introduction the author directs attention to the very complex nature of Indian silviculture, its limitations and possibilities. The immense area of country under the direction of the Indian Forest Service embraces all kinds of climatic conditions, from hot arid plains with a negligible rainfall to regions with a precipitation of 460 inches per annum; and from land sweltering under tropical heat and cloudless skies to alpine valleys shrouded in almost perpetual mist, and altitudes where the temperature is too low for the proper development of cold temperate trees. As the soil conditions are quite as variable, it might naturally be expected that the silva of the country would be rich in species, and such is the case. The timber of some of these species, though of local use, has little or no general application; and the author appears, in the first place, to have been undecided as to the advisability of including them amongst more important trees. Fortunately, he decided in favour of the wider view, and the result is a complete work on the forest trees of India, including a few important exotics, notably species of *Eucalyptus*. In dealing with the less important trees, Prof. Troup gives a

* The Silviculture of Indian Trees, by R. S. Troup, M.A., C.I.E. 3 vols. Published under the authority of His Majesty's Secretary of State for India in Council. Oxford, at the Clarendon Press.

botanical description, the general distribution, and the chief cultural requirements of the species, the whole in some cases being confined to a few lines or at most to half a page. But where important species are concerned, he goes very deeply into detail, in botanical description, distribution, cultural requirements, rate of growth, and other matters. The description of "Sal" (*Shorea robusta*), an important hardwood, for instance, occupies some 70 pages, whilst that of the "Deodar" (*Cedrus Deodara*), the most important coniferous tree of the Western Himalaya, covers 36 pages. In each case the description is full of detail, botanical and silvicultural. The excellent series of coloured drawings of seeds, germinating seedlings, and young plants are of the greatest interest. The other drawings, black and white and coloured, and also the photographs, are excellent in every way. W. D.

Forest Trees and Shrubs of Hungary.—This fine book* on the distribution of the trees and shrubs in Hungary was published just before the outbreak of the war, and has only just reached us through H.M. Stationery Office. It deals with the woody vegetation of the territory included in the pre-war Hungarian Kingdom, which comprises the Carpathians, the Alps of Croatia, Carinthia, and Hungary, Slavonia, the Transylvanian and Siebenburgen Mountains, and the great Hungarian plain. Five coloured maps show the physical geography of the region and the distribution of the more important species, comprising spruce, silver fir, yew, Austrian, Cembran, and common pines, larch, beech, green alder, three species of oak, chestnut, hornbeam, hop-hornbeam, lime, maple, ash, holly and lilac. The plates in the first volume are excellent reproductions of photographs of forest scenes, amongst which may be signalled out those of Austrian pine on limestone precipices, larch at a high altitude in the Tatra, and oak in Slavonia. The text is perhaps the most detailed description yet published of any territory, as regards the exact vertical and horizontal limits of the species which compose the forests. Much information is given on plant geography generally, and special chapters are devoted to the afforestation schemes that are being carried out in three remarkable districts: in the sandy parts of the Hungarian plain; in the desert, comparable to a small Sahara, of Deliblat, north of the Danube to the east of Belgrade; and in the Karst, the dreary limestone plateau which extends along the Adriatic coast from Fiume to Gorizia. The book should be procured by all lovers of trees and students of forestry. Its scientific value will also be appreciated by ecologists. A. HENRY.

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* L. Fekete und T. Blattny, Die Verbreitung der forstlichwichtigen Bäume und Sträucher im Ungarischen Staate. Selmecbànya: Aug. Joerges Witwe Sohn, Vol. i, 845 pages, 13 plates, 1914. Vol. ii, 150 pages, 5 coloured maps, 1913.

The Coco Nut.*—The first edition of this work appeared in 1914 [*see K. B.* 1914, p. 396], the author (now retired) being Professor of Physiology and Dean of the College of Agriculture, University of the Philippines. In the Foreword to the second edition, published this year, the author rightly directs attention to the fillip given to the industry during the Great War, and to the importance of the coconut, more particularly as a source of edible oil. During this period the cultivation of the tree has greatly extended; improved methods have been adopted for the preparation of copra for export, and the general standard of the industry has, in many other directions, been permanently raised. The matter is grouped into six chapters in the following order · Physiology of the Coconut, Climate and Soil, Diseases and Pests, Selection and Treatment of Seed, Field Culture, Coconut Products. This book appears to have been most carefully written, and is full of interest, and can most certainly be recommended to the notice of the tropical planter and to others connected with the industry. The illustrations are good, and there is an ample index. It may be noted that the price of the first edition was 10*s*., whereas that of the present edition has been raised to double that amount. J. M. H.

* The Coconut, by Edward Bingham Copeland. Second Edition, revised, pp. xvi, 225 with 23 illustrations. Macmillan & Co., Limited, St. Martin's Street, London, 1921.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 8] [1921

XXXVI.—NEW PLANTS FROM TROPICAL AND SOUTH AFRICA COLLECTED BY ARCHDEACON F. A. ROGERS.

N. E. Brown.

In the course of naming a collection of plants made by Archdeacon F. A. Rogers in South-eastern Congo, Rhodesia and South Africa, numerous species were found to be unrepresented in either the Kew or British Museum Herbaria and could not be identified from books; they are therefore presumed to be undescribed, and those of which the material is adequate are described below. They give evidence of the wealth of new plants that doubtless yet remain to be discovered in those regions.

Type specimens of all of them have very generously been presented to the Kew Herbarium by Archdeacon Rogers.

A few additional species met with in the course of working out Archdeacon Rogers' plants have also been included.

Ionidium Thorncroftii, *N. E. Brown* [Violaceae-Violeae]; *I. enneaspermo*, Vent., affinis, sed humilior, rhizomate perenni, caulibus pubescentibus, foliis latioribus, et pedicellis longioribus differt.

Herba perennis 9–12 cm. alta, rhizomate tenui reptante. *Caules* subfasciculati, erecti, 0·5–1 mm. crassi, internodiis 0·5–1·5 cm. longis, pilis minutis patulis curvatis pubescentes. *Folia* 2–4 cm. longa, 0·8–1·5 cm. lata, oblanceolata, acuta, inferne longe cuneata, dentata, petiolo brevissimo, utrinque glabra; stipulae 1–1·5 mm. longae, subulatae. *Pedicelli* axillares, 1·2–2·5 cm. longi, graciles, puberuli, prope apicem recurvati et bibracteati. *Bracteae* 1·5–2 mm. longae, subulatae. *Sepala* 4–4·5 mm. longa, 1·5 mm. lata, anguste oblonga vel oblongo-lanceolata, obtusa, apiculata, glabra. *Petala* superiora 4–6 mm. longa, 1·5–2 mm. lata, falcata, obtusa, marginibus incurvis; petalum inferum 1·2–1·3 cm. longum, 0·7 cm. latum, orbiculato-spathulatum, obtusum, integrum, concavum. *Stamina*

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2 mm. longa. *Ovarium* **subglobosum vel ellipsoideum, stylo curvato clavato truncato.** *Semina* **immatura levia, ut videtur haud costata.**

South Africa. Transvaal: on a hill-side at Reimers Creek, Barberton, 1050 m., Nov. 1920, *G. Thorncroft* 1086.

The flowers are stated to be pale blue. This species is readily distinguished from *I. enneaspermum*, Vent., which it somewhat resembles, by its creeping perennial rhizome, pubescent stems and longer pedicels. The seeds are immature, but appear to be smooth and quite destitute of the ribs seen on those of *I. enneaspermum*.

Sterculia Rogersii, *N. E. Brown* [Sterculiaceae-Sterculieae]; *S. triphacae*, R. Br., affinis, sed ramis gracilioribus, foliis minoribus breviter petiolatis et subtus minutissime albo-tomentosis differt.

Rami 3–5 mm. diametro, primum puberuli, demum glabri, cortice cinereo-brunneo. *Folia* alterna vel ad nodos fasciculata; petiolus 0·5–1·5 cm. longus, minute puberulus; lamina 1·5–4 cm. longa, supra viridis, minute stellato-pubescens, subtus albida, minutissime stellato-tomentosa. *Flores* (masculi tantum visi) fasciculati, in ramulos breves laterales ramorum efoliatorum dispositi. *Pedicelli* 4–5 mm. longi, minute stellato-tomentosi. *Calyx* 3–3·3 cm. diametro, extra minute stellato-tomentosus; discus patelliformis, intra glaber; lobi 1–1·2 cm. longi, 6–7 mm. longa, incurva.

Tropical Africa. Northern Transvaal: Messina, *F. A. Rogers* 22110, and also without locality 19352, 22242.

Triumfetta humilis, *N. E. Brown* [Tiliaceae-Grewieae]; affinis *T. hirsutae*, Sprague et Hutch., sed humilior, caulibus crassioribus dense tomentosis et foliis utrinque densius stellato-tomentosis differt.

Herba nana, erecta, 5–12 cm. alta. *Caules* 3–8 cm. alti, 3·5–5 mm. diametro, densissime fulvo-tomentosi, superne paucifoliati, inferne stipulis paucis magnis ovatis brunneis instructi. *Folia* patula; petioli 2–4 mm. longi; laminae 2–3 cm. longae, 0·7–1·2 cm. latae, oblongae vel lanceolato-oblongae, acutae vel subacutae, basi subcuneatae, irregulariter crenato-dentatae, supra pubescentes, subtus dense fulvo-tomentosae; stipulae 5–11 mm. longae, superiores 2·5–4 mm. latae, ovatae vel lanceolatae, acutae, inferiores late ovatae, obtusae, vel apice 2–3-dentatae brunneae, subtomentosae. *Cymae* compactae, 2·5–3·5 cm. diametro, dense multiflorae. *Pedicelli* 2–3 mm. longi, fulvo-tomentosi. *Sepala* 5, 7–10 mm. longa, 2–2·5 mm. lata, oblongo-linearia, obtusa, brunneo-apiculata, extra dense fulvo-tomentosa. *Petala* 5, circiter 6–8 mm. longa, 4 mm. lata, obovata, apice rotundata, lutea. *Stamina* circiter 25, petalis breviora. *Ovarium* dense hirsutum, stylo filiformi glabro.

Tropical Africa. Northwestern Rhodesia: Mazabuka, July 3, 1920, *F. A. Rogers* 26138.

Triumfetta misella, *N. E. Brown* [Tiliaceae-Grewieae]; affinis *T. rhodoneurae*, K. Schum., sed floribus duplo minoribus facile distinguitur.

Herba perennis 1–2 dm. alta. *Caules* erecti, 2–2·5 mm. diametro, fulvo-villosi. *Folia* sub anthesi vix expansa, in fasciculos ovoideos gemmiformes coarctata, 1–2 cm. longa, linearia, acuta, crenato-dentata, pilis stellatis fulvo-hirsuta. *Cymae* terminales, subpaniculatim dispositae, multiflorae, ramulis pedicellis calycibusque fulvotomentosis. *Pedicelli* 1·5–2 mm. longi. *Sepala* 5, circiter 6 mm. longa, 1–1·5 mm. lata, oblongo-linearia, brunneo-apiculata. *Petala* 5, circiter 4 mm. longa, 2 mm. lata, obovato-elliptica, apice rotundata, lutea. *Stamina* circiter 30–35, petalis breviora. *Ovarium* dense hirsutum, stylo filiformi glabro.

Tropical Africa. South-eastern Congo: Elisabethville, *F. A. Rogers* 26337.

This and *T. humilis*, N. E. Brown, above described, belong to the same group of the genus. Both plants evidently produce annual stems from a perennial rootstock. *T. misella* is taller, has more slender stems, narrower leaves and smaller flowers than *T. humilis*, but is otherwise similar in habit.

Triumfetta Rogersii, *N. E. Brown* [Tiliaceae-Grewieae]; species distincta ex affinitate *T. hirsutae*, Sprague et Hutch., sed foliis linearibus subdentatis et floribus minoribus differt.

Herba perennis, multicaulis, ad 1·8 dm. alta. *Caules* erecti, 1–2 mm. diametro, herbacei, pilis stellatis minutis et aliis longioribus pubescentes. *Folia* 1·2–2·5 cm. longa, 2–4 mm. lata, linearia, acuta, versus apicem denticulata, ciliata, supra glabra, subtus nervis pilis stellatis instructa, petiolo 1 mm. longo; stipulae 2–3 mm. longae, subulatae. *Cymae* terminales, multiflorae. *Pedunculus* 1·5–4 cm. longus, pubescens; pedicelli 1–3 (sub fructu 4–6) mm. longi, minute stellato-tomentosi. *Sepala* 4–5, minute stellato-tomentosa, 5–6 mm. longa, 1·5–2 mm. lata, spathulato-oblonga, apice brevissime cornuta. *Petala* 4–5, late obovata, obtusa, 4–4·5 mm. longa, 3–3·5 mm. lata, glabra, lutea. *Stamina* circiter 25–27. *Fructus* (setis 4–5 mm. longis inclusus) 1·3–1·5 cm. diametro; setae pilosae, apice substellato-barbatae.

Tropical Africa. South-eastern Congo: Elisabethville, June, 1920, *F. A. Rogers* 26263.

Crotalaria marginata, *N. E. Brown* [Leguminosae-Genisteae]; affinis *C. incomptae*, N. E. Brown, sed foliis angustioribus marginibus incrassatis et floribus minoribus differt.

Suffrutex perennis, 3–5 dm. alta. *Caules* e radice lignoso enati, superne angulati, 1 mm. diametro, inferne lignosi et crassiores, glabri. *Folia* simplicia, 5–7·5 cm. longa, 1–3 mm. lata, linearia, acuta, integra, marginibus incrassatis, glabra

vel inconspicue sparse et minutissime adpresse puberula, petiolo 1–3 mm. longo. *Racemi* 3–8 cm. longi, axillares et terminales, laxiflori, minutissime adpresse puberuli. *Bracteae* 2–2·5 mm. longae, lanceolatae, acuminatae. *Pedicelli* 2 mm. longi. *Calyx* 2·5 mm. longus, subaequaliter 5–dentatus, dentibus 1 mm. longis et latis deltoideis acutis. *Corolla* glabra; vexillum 5–5·5 mm. longum et latum, pallide violaceum?; alae 6·5–7 mm. longae, prope apicem 3 mm. latae, subobovatae, apice obtusissime rotundatae, basi auriculatae; carina 6–7 mm. longa, apice subabrupte acuminata et porrecta nec incurvata. *Ovarium* stipitatum, glabrum, 3-ovulatum.

Tropical Africa. Congo: Elisabethville, *F. A. Rogers* 26286, 26288.

The three species *C. incompta*, *C. filifolia*, and *C. marginata*, are all closely related, but are easily distinguished by their flowers. In *C. marginata* the wings of the corolla are as long as the keel and dilated at the broadly rounded apex. In *C. filifolia* and *C. incompta* the wings are much shorter than the keel, and *C. filifolia* has falcate acute wings, whilst in *C. incompta* they are oblong and obtuse.

Indigofera similis, *N. E. Brown* [Leguminosae-Galegeae]; similis *I. hilari*, Eckl. et Zeyh., sed racemis longioribus et calycis dentibus multo brevioribus conspicue differt.

Herba perennis. *Caules* plures, 1·5–3 dm. alti, 1–1·5 mm. diametro, inferne pilis patulis breviter hispidi, superne minute appresse pubescentes. *Folia* alterna, abrupte pinnata, rhachi 5–8 mm. longa; foliola 2–3-juga, 0·7–1·4 cm. longa, 1·5–3·5 mm. lata, lanceolato-oblonga, mucronato-acuta, utrinque sparse appresse puberula; stipulae 2–3 mm. longae, subulatae. *Racemi* axillares, 2–4 cm. longi, graciles, saepe 10–14-flori, floribus 1·5–3 mm. distantibus, rachi pedicellis calycibusque minute appresse pubescentibus. *Pedicelli* 0·5–1 mm. longi. *Calyx* subaequaliter 5-dentatus; tubus 0·5–1 mm. longus; dentes 2–2·5 mm. longi, subulati. *Corolla* purpurea; vexillum 6–7 mm. longum, 4–5 mm. latum, ellipticum, extra minute appresse pubescens; alae 5–5·5 mm. longae, obtusae; carina 6·5–7 mm. longa, extra minute appresse pubescens. *Ovarium* dense appresse albo-pubescens.

Tropical Africa. South-eastern Congo: Elisabethville, *F. A. Rogers* 26210.

Aeschynomene humilis, *N. E. Brown* [Leguminosae-Hedysareae]; affinis *Ae. pygmaeae*, Welw., sed foliolis majoribus venis obsoletis, stipulis latioribus et pedicellis brevioribus differt, et probabiliter *Ae. katangensi*, De Wild., sed racemis et pedicellis glanduloso-pubescentibus (nec glabris) differt.

Caules 1–2 dm. alti, erecti, simplices vel superne paniculato-ramosi, glanduloso-pubescentes, brunnei, interdum aphylli. *Folia* 0·7–1·3 cm. longa, rachi minute setulosa et glandulosa; foliola 7–10-juga, 3–4 mm. longa, 1 mm. lata, oblonga, mucronata,

glabra, primum glanduloso-ciliata; stipulae 4–6 mm. longae, 1·5–3 mm. latae, ovatae vel ovato-lanceolatae, basi exappendiculatae. *Racemi* 2–6 cm. longi, in paniculam terminalem dispositi vel interdum solitarii, pluriflori, glanduloso-pubescentes. *Bracteae* 3–3·5 mm. longae, ovatae, acutae, striatae, glabrae, glanduloso-ciliatae. *Pedicelli* 1·5–2 mm. longi, glanduloso-pubescentes. *Bracteolae* circiter 3 mm. longae, ovatae, acutae, ciliatae. *Calyx* 6 mm. longus, glaber, sordide purpureus. *Corolla* glabra, carina ciliata excepta, lutea; vexillum 7 mm. longum; alae 8 mm. longae; carina 5 mm. longa. *Ovarium* minute appresse pubescens, stylo 2·5 mm. longo glabro.

Tropical Africa. South-eastern Congo: Elisabethville, *F. A. Rogers* 26160.

Aeschynomene recta, *N. E. Brown* [Leguminosae-Hedysareae]; affinis *Ae. mimosaefoliae,* Vatke, sed caulibus erectis nec patulis et floribus minoribus differt.

Caules 6–8 dm. alti, erecti, porrecti, 2–3 mm. diametro, lignosi, brunnei, dense et breviter setifero-hispidi, ramulis numerosissimis 0·5–2·5 cm. longis instructi. *Folia* perparva, 4–10 mm. longa, rachi appresse setifera; foliola 7–14-juga, 1·5–3 mm. longa, 0·5 mm. lata, subfalcato-linearia, mucronata, glabra; stipulae 2·5–5 mm. longae, 0·5–0·75 mm. latae, linearia-attenuatae vel anguste lanceolatae, mucronatae, basi exappendiculatae. *Racemi* numerosi, 3–6 cm. longi, simplices vel inferne ramulosi, vel foliis vel stipulis instructi, glanduloso-hispidi, adscendentes, in paniculam terminalem dispositi. *Bracteae* 2–3 mm. longae, ovatae, mucronatae, striatae. *Pedicelli* 1–1·5 mm. longi, glanduloso-hispidi. *Bracteolae* 2·5 mm. longae, lanceolatae, acuminatae, minute ciliatae. *Calyx* 4·5 mm. longus, minute hispidus et ciliatus. *Corolla* glabra, lutea, vexillo circa 5 mm. longo, alis 7 mm. longis, carina 4·5 mm. longa ciliata. *Ovarium* minute appresse pubescens, stylo glabro 2 mm. longo.

Tropical Africa. Congo: Elisabethville, *F. A. Rogers* 26162.

Aeschynomene Rogersii, *N. E. Brown* [Leguminosae-Hedysareae]; similis *Ae. glutinosae,* Taub., sed panicula scabrida nec glutinosa et venulis foliolorum indistinctis facile distinguitur.

Suffrutex 4–6·6 dm. altus, ramosus, lignosus, cortice brunneo. *Rami* superne ad paniculam vel racemum plus minusve scabri et glanduloso-pubescentes, inferne glabri, ramulis numerosis brevissimis foliosis axillaribus instructi. *Folia* 5–10 mm. longa, glabra, rachi subtus scabra; foliola 6–12-juga, 2–3·5 mm. longa, subfalcato-linearia, mucronata; stipulae 4–10 mm. longae, anguste lanceolatae, mucronato-acuminatae, basi auriculatae. *Racemi* 6–12 cm. longi, ascendentes, in paniculam terminalem scabrum laxe dispositi vel interdum solitarii, basi plus minusve foliosi. *Bracteae et bracteolae* similes, circiter 3 mm. longae, ovatae, acutae, violaceae. *Pedicelli* 2·5–3·5 (sub fructu ad 5) mm. longi, minute scabri et glandulosi. *Calyx* 6 mm. longus, glaber

non ciliatus. *Corolla* glabra, lutea; vexillum 7 mm. longum; alae 7·5 mm. longae; carina 6 mm. longa. *Ovarium* glabrum, dorso ciliatum, stylo 2 mm. longo glabro. *Legumen* stipitatum, 1–2-articulatum, articulis 6·7 mm. longis 5 mm. latis semicircularibus compressis glabris marginibus incrassatis.

Tropical Africa. South-eastern Congo: Elisabethville, *F. A. Rogers* 26159, 26161.

Adenodolichos nanus, *N. E. Brown* [Leguminosae-Phaseoleae]; *A. pachyrhizo,* De Wild., affinis, sed foliis et floribus majoribus et racemis et pedicellis brevioribus differt.

Caules ad 1 dm. (vel ultra?) longi, erecti, glabri, internodiis 0·5–1 cm. longis. *Folia* alterna, trifoliolata; petioli 4–9 cm. longi; foliola 5–9·5 cm. longa, 3–5·5 cm. lata, rhomboideo-ovata, lateralia obliqua, basi obtusa, apice obtusissima vel emarginata, supra glabra, subtus glabra glandulis minutis aurantiacis parce conspersa, margine et venis prominentibus et parce pubescentibus. *Racemi* ad nodos ramulorum aphyllorum 2–3 cm. longorum subsolitarii, 9–15 cm. longi, pedicellis et calycibus glanduloso-pubescentibus. *Bracteae* 4 mm. longae, anguste lanceolatae, acutae, pubescentes. *Pedicelli* 3–5 mm. longi. *Bracteolae* 1–2 mm. longae, subulatae. *Calycis tubus* 4 mm. longus; lobi 5 mm. longi, lanceolati vel oblongo-lanceolati, acuti, duo superiores ad medium connati. *Corolla* 1·4 cm. longa, glabra, atroviolacea. *Ovarium* puberulum, eglandulosum, stylo glabro apice unilateraliter dense piloso.

Tropical Africa. South-eastern Congo: Elisabethville, *F. A. Rogers* 26212.

The leaves of this plant, being erect, rise to the level of or overtop the stem, and seem large for the size of the plant.

Alistilus, *N. E. Brown* [Leguminosae-Phaseoleae]; genus novum affine *Dolicho,* Linn., sed stylo plano et bialato superne dilatato glabro, stigmate truncato, et foliolis lobatis differt.

Calyx ebracteatus, campanulatus, breviter 5-dentatus, dente infimo acuto, ceteris rotundatis vel obtusis. *Vexillum* orbiculatum apice brevissime bilobum, basi bicallosum. *Alae* prope basin gibbositate oblonga instructae, nec hamatae. *Carina* incurvata, obtusissima. *Stamina* ad medium monadelpha, basi et apice diadelpha, unico libero basi intra appendiculato. *Ovarium* lineare, 5-ovulatum. *Stylus* abrupte inflexus, planus, bialatus, obcuneatus, glaber, stigmate terminali truncato glabro.

Alistilus bechuanicus, *N. E. Brown*; species unica. *Herba* procumbens. *Caules* teretes, ad 3 mm. diametro, puberuli, internodiis 3–7 cm. longis. *Folia* trifoliolata, stipellata; petiolus 2–4 cm. longus, teres, supra canaliculatus, puberulus; foliola 3–6 cm. longa, 2·5–7 cm. lata, utrinque parce puberula, marginibus minute et dense ciliatis; foliola lateralia rhomboideo-biloba, lobo exteriore rotundato, lobo interiore acuto; foliolum medium deltoideum acutum; stipulae 5–6 mm. longae, ovatae, acutae, nervosae, puberulae. *Pedunculi* erecti, 1·5–2·4 dm. longi,

2–2·5 mm. diametro, inferne nudi, superne racemoso-floriferi, puberuli. *Pedicelli* 4–8 mm. longi, puberuli, axillis tuberculiferis. *Calyx* 3·5–4 mm. longus, campanulatus, breviter 5-dentatus, puberulus et minute ciliatus. *Corolla* 1·2 cm. longa, glabra. *Ovarium* 6 mm. longum, minute appresso-pubescens; stylus 6 mm. longus, apice 1–1·3 mm. latus.

South Africa. Bechuanaland: Soshong, *Holub*; Mochudi, *F. A. Rogers* 6311.

The flowers of this plant are similar to those of *Dolichos*, but the prostrate stems, which show no trace of twining, lobed leaves, and the peculiar obcuneate winged style, truncate and glabrous at the apex, sufficiently distinguish it from that genus as well as from *Sphaenostylis*.

Vernonia fraterna, *N. E. Brown* [Compositae-Vernonieae]; *V. Bellinghamii*, S. Moore, simillima, sed capitulis distincte pedunculatis nec subsessilibus majoribus et laxioribus facile distinguitur.

Frutex erectus, ramosus; rami dense tomentosi. *Folia* supra glabra, subtus dense albo-tomentosa; petiolus 6–10 mm. longus; lamina 5–8 cm. longa, 2–5 cm. lata, elliptica vel ovato-elliptica, apice acuta, basi rotundata vel late cuneata, margine minute denticulata vel leviter sinuata. *Corymbi* terminales, circiter 4 cm. diametro, 12–16-cephali, pedunculo 0·6–1·2 cm. longo. *Capitula* circiter 10-flora, 1·2 cm. longa, 7–8 mm. diametro, pedicellata; pedicelli 4–7 mm. longi, tomentosi. *Involucrum* 6–7 mm. longum, ellipsoideo-oblongum, squamis sub-5-seriatis late ovatis obtusis marginibus subtomentellis brunneis; receptaculum minute denticuliferum. *Pappi setae* 5 mm. longae, scabrae. *Corolla* 8 mm. longa, glabra. *Achenia* 4 mm. longa, angulata, striata, glabra.

Tropical Africa. North-west Rhodesia: Bwana M'Kubwa, *F. A. Rogers* 8310; Mukwela, *F. A. Rogers* 26027.

Sphaeranthus Rogersii, *N. E. Brown* [Compositae-Inuloideae]; *S. hirto*, Willd., affinis, sed pedunculis brevioribus, capitulis depresso-globosis et foliis nec spinuloso-dentatis differt.

Herba perennis ad 3·5 dm. (vel ultra?) alta, basi ramosa, molliter villosa. *Rami* erecti, simplices vel superne pauciramosi, conspicue alati. *Folia* sessilia, in alas decurrentia, 3–5·5 cm. longa, 0·6–1·7 cm. lata, superiora minora, oblongo-lanceolata, acuta, dentata, dentibus parvis acutis nec spinulosis, demum subglabrescentia. *Pedunculi* laterales vel terminales, 7–10 mm. longi. *Capitula primaria* circiter 1 cm. diametro, depresso-globosa, purpurea; involucri bracteae 14–16, biseriatae, 5–6 mm. longae, oblongo-lanceolatae, acutae, exteriores mucronatae. *Capitula secundaria* numerosissima, 5 mm. longa; involucri squamae 4–5, oblongo-lineares, obtusae, 4 mm. longae; flores masculi 1–2; flores feminei 3–4.

Tropical Africa. North-western Rhodesia: Mazabuka, *F. A. Rogers* 26359.

Plectranthus leviculus, *N. E. Brown* [Labiatae-Ocimoideae]; *P. tetragona*, Gürke, affinis, sed humilior, floribus minoribus et calycis dentibus longioribus differt.

Herba annua(?), 3·5–4 dm. alta, e basi ramosa. *Rami* erecti, 1·5–3 mm. diametro, quadrangulares, pilis patulis parce pubescentes. *Folia* opposita, 2–2·5 cm. longa, 1–1·5 cm. lata. rhomboideo-ovata, obtusa, basi in petiolum brevissimum cuneate attenuata, paucidentata vel subintegra, utrinque glabra. *Racemi* numerosissimi, axillares, 2·5–4 cm. longi, laxe 10–24-flori, ut pedicelli calycesque glanduloso-pubescentes. *Pedicelli* 2–3 mm. longi, patuli. *Calycis tubus* 1 (sub fructu 3) mm. longus; dentes superiores 1·5 (sub fructu 2) mm. longi; dentes inferiores 2 (sub fructu 3) mm. longi, omnes aristati, porrecti. *Corolla* perparva, 6 mm. longa; tubus 3 mm. longus, basi leviter curvatus; labium superum 1 mm. longum, erectum, subtruncatum, glabrum; labium inferum concavum ciliatum.

Tropical Africa. South-eastern Congo: Elisabethville, June, 1920, *F. A. Rogers* 26211.

The numerous racemes and very small insignificant flowers, which seem to develop one at a time on each raceme, appear to be well-marked characteristics of this species.

Loranthus (Acrostachys) messinensis, *N. E. Brown* [Loranthaceae-Eulorantheae]; *L. Kirkii*, Oliv., affinis, sed foliis carnosioribus, floribus paucioribus laxioribus et duplo longioribus differt.

Rami teretes 5–6 mm. diametro, glabri, internodiis 1·5–4 cm. longis, demum cinerei. *Folia* opposita vel subalterna, crassa, carnosa, glabra; petiolus 1–1·2 cm. longus; lamina 2·5–4·5 cm. longa, 1·5–3·5 cm. lata, ovata vel elliptica, basi cuneata, apice obtusa vel rotundata. *Racemi* 1–1·4 dm. longi, basi 2 mm. diametro, laxiflori, toto glabri. *Pedicelli* 2–3 mm. longi. *Bractea* 1 mm. longa, late ovata, acuta, concava. *Calyx* truncatus, haud denticulatus. *Corolla* 1·8 cm. longa, 2·5 mm. diametro, cylindrica, obtusa; petala 4 vel interdum 3, libera, linearia, exsiccando aurantiaca. *Antherae* 8 mm. longae, biloculares. *Stylus* 1 cm. longus, 4-angulatus; stigma simplex.

Tropical Africa. North Transvaal: Messina, Feb. 1919, *F. A. Rogers* 22568.

Acalypha multifida, *N. E. Broun* [Euphorbiaceae-Crotoneae]; affinis *A. Stuhlmanni*, Pax, sed foliis anguste oblongis vel oblongo-lanceolatis, floribus masculis a flore feminea spatio longo nudo non separatis, et bractea feminea multifida differt.

Herba perennis, monoica vel forsan subdioica. *Caules* erecti, 1–2·5 dm. alti, pubescentes, e rhizomate lignoso orientes. *Folia* erecto-patula; petiolus 1–2 mm. longus, pubescens; lamina 2–7 cm. longa, 0·8–1·6 cm. lata, oblongo-linearia, oblongo-lanceolata vel minora elliptico-lanceolata, acuta, basi obtusa, inferne integra, superne breviter dentata, utrinque pilis conspersis parce pubescentia; stipulae subulatae. *Spicae* axillares, inferiores hermaphroditae et superiores femineae vel

omnes femineae et superiores interdum confertae; spicae hermaphroditae basi floribus femineis 1–3 instructae, deinde pergraciles et masculae, 1–2·5 cm. longae, floribus masculis et femineis contiguis. *Bractea* 7–10 mm. longa, ad medium multifida, dentibus 3–6 mm. longis subulatis acutis pubescentibus. *Ovarium* pubescens. *Styli* 8 mm. longi, filiformes, longe ciliati. *Capsula* 5 mm. diametro, pubescens. *Semina* 2·5 mm. longa, ellipsoidea, levia, glabra, brunnea.

Tropical Africa. South-eastern Congo: Sakania, *F. A. Rogers* 13879.

Ficus cognata, *N. E. Brown* [Moraceae]; affinis *F. Spragueana*, Mildbr. et Burr., sed cortice fusco, foliis majoribus obtusioribus, venis primariis subtus vix et secundariis haud prominentibus differt.

Rami juniores plus minusve puberuli, demum glabri, cortice fusco. *Folia* chartacea, glabra; petiolus 1·3–2·8 cm. longus; lamina 6·5–10·5 cm. longa, 2·5–5 cm. lata, oblonga, vel leviter obovato-oblonga, apice obtusa, basi angustata, obtusa, costa subtus prominente convexa, venis primariis utrinque circiter 10–15 levissime prominentibus secundariis haud prominentibus subtiliter reticulatis. *Receptacula* axillaria, globosa, 8–9 mm. diametro, pedunculis 2–4 mm. longis, dense albotomentosa: ostiola poriformia, linearia. *Bracteae* basilares 3, latissime ovatae, pubescentes.

Tropical Africa. Congo: Elisabethville, *F. A. Rogers* 26167.

This species is also allied to *F. basarensis*, Warb., but has much firmer leaves, with the veins much more finely reticulated, and the figs are shortly stalked, not sessile as in that species.

Acidanthera holostachya, *N. E. Brown* [Iridaceae-Ixieae]; comb. nov.—*Lapeyrousia holostachya*, Baker in *Kew Bull.* 1894, p. 391.

Tropical Africa. Nyasaland: Fwambo, *Carson* 14.

This and the following species were described by Mr. Baker under the genus *Lapeyrousia*, from which they differ in habit and by their undivided (not bifid) stigmas. The segments of the perianth are slightly more unequal in width than in most of the species of *Acidanthera* and these two species and a new one (*A. lomatensis*), described below seem to form a connecting link between *Acidanthera* and *Gladiolus*, for there are some species of *Gladiolus* that have their perianth-segments scarcely, if any, more unequal than they are in the type of the genus *Acidanthera*. The very long and slender tube of the flowers of the latter genus seems about the only character that really separates the two genera, and that is very marked in all the species, being very much longer than the spathes, whilst in *Gladiolus* it is rarely much longer and often shorter than the spathes.

Acidanthera leptostachya, *N. E. Brown* [Iridaceae-Ixieae], comb. nov.—*Lapeyrousia leptostachya*, Baker, Handb. Irid. p. 170,

South Africa. Transvaal: Lydenburg Div.; Macmac, *Mudd.*

Acidanthera lomatensis, *N. E. Brown* [Iridaceae-Ixieae]; *A. leptostachyae*, N. E. Brown, similis, sed spathis majoribus et perianthio duplo longiore facile distinguitur.

Planta circiter 4–4·5 dm. alta, omnino glabra. *Bulbus* circa 1 cm. diametro. *Folia* 4-6, adscendentia, 1·5–1·7 dm. longa, 4–8 mm. lata, linearia, acuta, tenuia, uninervia. *Spica* simplex vel 2–3-ramosa, laxa, floribus 0·8–1·5 cm. distantibus. *Spathae* 1–1·7 cm. longae, lanceolatae, acuminatae, virides, membranaceo-marginatae. *Perianthium* siccato pallide caeruleo-purpureum; tubus 2·5–4 cm. longus, gracilis; segmenta 1·2–1·3 cm. longa, segmento superiore 3–3·5 mm. lato lanceolato acuto levissime galeato, ceteris multo angustioribus linearibus acutis. *Stamina* perianthio breviora; antherae 4 mm. longae. *Stylus* staminibus subaequilongus; stigmata 2·5 mm. longa, compressa, integra.

South Africa. Transvaal: Lomati Valley; near Barberton, among rocks, 1200 m., Nov. 1919, growing with *Begonia Dregei* (?) *G. Thorncroft* 1065.

Gladiolus nudus, *N. E. Brown* [Iridaceae-Ixieae]; species ab omnibus sectionis *Hebeae* caulibus aphyllis facile distinguitur. *Planta* 4·5–5 dm. alta. *Caulis* circiter 1·5 mm. diametro, circiter quinque vaginis striatis aphyllis vestitus, superiore et inferiore glabris ceteris pilis patulis tenuiter conspersis. *Spica* circiter 9 cm., longa, 6–7-flora, secunda, floribus 1–2 cm. distantibus. *Spathae* 1–1·3 cm. longae et circiter 4 mm. latae, glabrae. *Perianthium* 2–2·5 cm. diametro, luteum, viridi-tinctum; tubus 1 cm. longus, apice 2 mm. diametro; lobi unguiculati, unguibus 3–5 mm. longis, laminis elliptico-ovatis obtusis apiculatis, tribus superioribus 1·5–1·7 cm. longis et 1–1·3 cm. latis, tribus inferioribus minoribus. *Stamina* perianthio breviora; antherae 7 mm. longae. *Stylus* staminibus subaequilongus.

South Africa. Transvaal: near Barberton, Oct. 1919, *G. Thorncroft* 1067.

Upon the label the flowers are stated to be "yellow, tinged green," but those of the dried specimens appear to have the five lower segments of a dull and somewhat greenish-yellow, and the dorsal segment of a pale purplish hue, and there are some blackish-purple spots at the base of the claws of the lower segments.

Asparagus longicladus, *N. E. Brown* [Liliaceae-Asparageae]; *A. retrofracto*, Linn., affinis, sed ramulis puberulis et cladodiis duplo longioribus differt.

Caules teretes, scandentes, glabri, brunnei; ramuli deflexi, primum puberuli et virides, demum glabri et brunnei. *Cladodia* numerosa, dense aggregata, 4–5 cm. longa, 0·3 mm. crassa, subfiliformia, acuta, glabra. *Folia* basi in spinas deflexas 2–5 mm. longas brunneas producta. *Pedunculi* plures, 2 mm. longi. *Flores* umbellati? *Pedicelli* 5·5–6 mm. longi, supra medium articulati. *Perianthium* emarcidum 2·5 mm. longum.

Tropical Africa. Southern Rhodesia: Victoria Falls; 900 m., *F. A. Rogers* 5523.

The flowers of this species appear to be arranged in few-flowered umbels, but only two withered flowers were found on the specimen, each on a separate peduncle, all the others having fallen off.

Drimiopsis atropurpurea, *N. E. Brown* [Liliaceae-Scilleae]; species floribus atropurpureis ab omnibus differt.

Folium unicum, semper?; petiolus 7–12 cm. longus, piloso-pubescens; lamina 9–15 cm. longa, 5–7 cm. lata, elongato-ovata, basi leviter cordata, apice acuta, supra glabra, subtus piloso-pubescens. *Scapus* 1·8–3 dm. longus, subgracilis, 1–2 mm. diametro, piloso-pubescens. *Racemus* 2·5–7 cm. longus, dense multiflorus, floribus inferioribus minutis abortivis delapsis, superioribus perfectis adscendentibus. *Bracteae* nullae. *Pedicelli* 1 mm. longi. *Perianthium* 3·5 mm. longum, campanulatum, glabrum, atropurpureum; segmenta oblonga, 3 exteriora acuta, apice incurva, 3 interiora obtusa et breviter bifida, cucullata. *Stamina* inclusa; antherae pallide luteae. *Ovarium* pallidum, stylo 1 mm. longo.

South Africa. Transvaal: in the shade of bushes at Roses Creek, near Barberton, Nov. 1920, *Thorncroft* 1083.

Scilla lauta, *N. E. Broun* [Liliaceae-Scilleae]; *S. polyanthae*, Baker, affinis, sed foliis acutioribus, racemo angustiore, et floribus pallide roseis conspicue differt.

Folia erecto-patula, basi in collum 0·8–1 dm. longum convoluta, supra collum 1–2 dm. longa, inferna 4–5 cm. lata, late canaliculata, attenuato-lanceolata, apice convoluto-acuta, glabra. *Scapus* infra flores 1·5–1·6 dm. longus; racemus 0·9–1 dm. longus, 1·5–2 cm. diametro, multiflorus. *Bracteae* abortivae, papilliformes, 0·5 mm. longae. *Pedicelli* 4–5 mm. longi, tenues. *Perianthium* horizontaliter patulum, campanulatum, siccato 4 mm. longum, pallide roseum; segmenta late linearia, apice acuta, inflexa. *Stamina* perianthio breviora; filamenta purpurea; antherae violaceae.

South Africa. Transvaal: Pietersburg Div.; The Downs, Oct. 1918, *F. A. Rogers* 23990.

Scilla lepida, *N. E. Brown* [Liliaceae-Scillcae]; *S. aggregatae*, Conrath, similis, sed foliis ciliatis et pedunculo pubescente facile distinguitur.

Planta parva. *Bulbus* ad 1·5 cm. diametro, ovoideus vel subglobosus. *Folia* saepe 2–3, suberecta, 3–5 cm. longa, 3–8 mm. lata, lanceolata, acuta, basi attenuata, minute ciliata. *Scapus* infra flores 3–5 cm. longus, minute pubescens; racemus 1–1·5 cm. longus, 1–1·2 cm. latus, breviter oblongus, obtusus, circiter 13–20-florus. *Bracteae* minute dentiformes. *Pedicelli* 2–2·5 mm. longi, patuli, glabri, purpurei. *Perianthium* horizontaliter patulum siccato 3·5 mm. longum, cylindrico-campanulatum, glabrum, intense purpureum; segmenta oblongo-linearia, apice

acuta, inflexa. *Stamina* inclusa; filamenta purpurea; antherae violaceae, polline albo.

South Africa. Transvaal: near the Palala River, Jan. 1918, *Breyer in Herb. F. A. Rogers* 24009.

Scilla sodalicia, *N. E. Brown* [Liliaceae-Scilleae], nom. nov.—*S. socialis*, Chevalier in Bull. Soc. Bot. France. lv. Mém. 8, p. 94 (1908), non Baker.

Tropical Africa. Middle Shari Region: Ngara, *Chevalier* 8425; Goundi, *Chevalier* 8607.

The name *S. socialis* was used by Baker (in Saunders, Refugium Botanicum, iii, t. 180) in 1870 for a South African species.

Ornithogalum longivaginatum, *N. E. Brown* [Liliaceae-Scilleae]; *O. Saltmarshei*, Baker, similis, sed bulbo minore, foliis scapo equilongis vel longioribus, et vaginis longissimis differt.

Bulbus circiter 1·8 cm. diametro, globosus. *Folia* 2, circiter 3 dm. longa, 2–4 mm. lata, scapo aequilonga vel longiora, erecta, vagina 2–2·5 dm. longa, linearia, subobtusa, glabra. *Scapus* supra vaginae 1·2–3 dm. longus, 1·5–2 mm. diametro, teres, glaber. *Racemus* 2–5 cm. longus, 1·8–2 cm. diametro, densiflorus. *Bracteae* 7–10 mm. longae, ovato-lanceolatae, longe acuminatae, membranaceae, albae, rubro-carinatae. *Pedicelli* patuli, 5–6 mm. longi, glabri. *Perianthium* 5–6 mm. longum, campanulatum, segmentis oblongis apice subcucullatis albis dorso pallide rubescente univittatis. *Capsula* 4–4·5 mm. longa, 6–8 mm. lata, acute triquetra, rubro-brunnea, glabra. *Semina* irregulariter angulata, glabra, nigra.

South Africa. Transvaal: Palala River, Jan. 1918, *H. G. Breyer in Herb., F. A. Rogers* 24011.

Mariscus chersinus, *N. E. Brown* [Cyperaceae-Scirpeae]; *M. Sieberiano*, Nees, affinis, sed spiculis duplo crassioribus conspicue differt.

Folia 2–4 dm. longa, 2·5–5 mm. lata, linearia, acuta, margine leviter scabrida. *Culmus* 2·5–4 dm. longus, triangularis, glaber. *Umbella* 5–10-radiata, foliis 3–7 involucrata; radii 1–6 cm. longi. *Spicae* 1–2 cm. longae, 6–7 mm. latae, cylindricae, obtusae. *Spiculae* dense confertae, patulae, turgide compresso-fusiformes, 3 mm. longae, 1 mm. crassae, uniflorae, glumis fertilibus carinatis explanatis late ovatis acutis pallidis viridi-carinatis. *Achenia* 2 mm. longa, 1·25 mm. lata, obovata, acute triangularia, levia, brunnea, nitidula; stylus trifidus.

Tropical. Africa. Ngamiland: Kwebe Hills; in dry places amongst rocks, 990 m., *Mrs. E. J. Lugard* 142.

South Africa. Bechuanaland: at Mochudi near the Transvaal border, *F. A. Rogers* 6310.

Scirpus confusus, *N. E. Brown* [Cyperaceae-Scirpeae]; *S. Rogersii*, N. E. Brown, similis, sed setis nullis, nucis angulis distincte transversim rugosis vel denticulatis, et patria differt.

Culmi dense caespitosi, erecti, 3·5–7·5 dm. alti, 2·3 mm. diametro, teretes, striati, basi vaginibus 7–14 cm. longis obtusis

vel mucrone minuto serrulato terminatis vestiti. *Spicae* laterales, 5–11 cm. infra apicem culmorum dense conferti, 5–9 mm. longi, 2·5–3 mm. crassi, cylindrico-ovati, acuti. *Glumae* 2·5–3 mm. longae, 1·5 mm. latae, ovatae, mucronato-acutae, apice erectae, pallide brunneae, apice marginibusque castaneae. *Setae* nullae. *Nux* 1·5 mm. longa, 1·25 mm. lata, late obovata, truncata, breviter apiculata, triangularis, faciebus planis et angulis prominente transversim rugosis, nigra. *Stylus* 1·25 mm. longus; stigmata 3, circiter 1·5 mm. longa.—*S. supinus* var. *uninodis*, C. B. Clarke in Dyer, Fl. Trop. Afr. viii. p. 453, non C. B. Clarke in Hook. f. Fl. Brit. Ind. vi. p. 656.

Tropical Africa. Abyssinia: Amogai, 2160 m., *Schimper* 253.

This species was identified by Mr. Clarke with the Indian plant he had previously described as *S. supinus*, var. *uninodis*, but it very conspicuously differs from that plant not only in stature, habit and general appearance, but also in structural details. And both this and the Indian plant distinctly differ from the Egyptian *Isolepis uninodis*, Delile, with which Mr. Clarke has supposed them to be identical; for besides the difference in locality and appearance, the Egyptian plant differs in having only two stigmas.

Scirpus Rogersii, *N. E. Brown* [Cyperaceae-Scirpeae]; *S. supino*, Linn., affinis, sed multo elatior et robustior, umbellis radiatis et glumis longioribus acutis differt.

Culmi caespitosi, 4·5–6 dm. alti, 2·5–3 mm. diametro, teretes, apice acuti, glabri. *Vaginae* obtusae breviter mucronatae, glabrae, virides, late membranaceo-marginatae. *Umbellae* 3–5 cm. infra apicem culmorum laterales, e 5–6 fasciculis spicarum 1–1·5 cm. diametro compositae, fasciculorum unus sessilis ceteri radiis 0·2–1·2 cm. longis suffulti. *Spiculae* 5–7 mm. longae, 2–2·5 mm. crassae, conico-ovatae, acutae. *Glumae* 3 mm. longae, ovatae, mucronatae, apice acutae non recurvatae, carinatae, submembranaceae, glabrae, pallide badiae, apice nigro-brunneae. *Setae* 4–5, nuci subaequilongae, leviter barbatae. *Nux* circiter 1·5 mm. longa et 1·25 mm. lata, late obovata, truncata, breviter apiculata, triangularis, faciebus planis lineis impressis irregularibus transversis notatis, angulis levibus, nigra, nitida. *Stylus* 0·5 mm. longus; stigmata 3, circa 2 mm. longa.

Tropical Africa. Southern Rhodesia: Matopos, May 1915, *F. A. Rogers* 7914.

This is very similar in general appearance to the Abyssinian plant described above as *S. confusus*, N. E. Brown, but differs from that by the presence of long setae under the nut, the very short style and the smooth angles of the nut.

XXXVII.—FLOWERING OF ARUNDINARIA FALCATA IN THE TEMPERATE HOUSE.

J. S. Gamble.

Recent visitors to the Temperate House may have noticed, in several places, the interesting event of the flowering of *Arundinaria falcata*, Nees, one of the small bamboos of the Western Himalaya. The drawings by Miss D. K. Hughes, which accompany this note, will give an idea of the flowers. They bring out the peculiar feature that the panicles from the lower nodes of the flowering culm are lax and much branching, while those from the upper nodes are of the ordinary fascicled type as is figured in Plate II of the "Bambuseae of British India" and in Fig. 199 of Sir Henry Collett's "Flora Simlensis." The clumps which have now flowered, all at the same time, are practically without leafy culms and will, presumably, die completely when the flowers are over. It is too soon to say whether or not they will afford ripe seed capable of giving plants to replace the old ones.

The history of *Arundinaria falcata* and its confusion, in European nurseries and gardens, with another species, *A. Falconeri*, was fully gone into in Dr. Stapf's paper on "Himalayan Bamboos" published in the "Gardeners' Chronicle" in their numbers for May 14 and 21 and June 4, 1904, and need not again be recapitulated; but there is reason to think that, in spite of the question having been so fully cleared up, there are still to be found cases where the much more common and more hardy *A. Falconeri* is still called in error *A. falcata*. The present note and Miss Hughes' pictures may therefore be of use. *A. Falconeri* was figured in the Botanical Magazine for 1904 in Plate No. 7947, also in Plate 18 of the "Bambuseae of British India."

So far as is known at present, there are 4 species of *Arundinaria* in the North-Western Himalaya and *A. falcata*, Nees, is a comparatively low-level one found in moist valleys and ravines in the undergrowth chiefly of oak forests at from 4000 to 7000 ft. elevation, rarely higher up. It has caespitose stems in close clumps and the culms are slender, up to 10 or 15 ft. long and about half an inch in diameter. They are not much used, unless other stronger kinds are not available. They do not, as has sometimes been stated, die down every year, though, of course, in exceptionally cold winters those not fully protected by overhead cover may sometimes get cut back. This bamboo has been successfully grown at Dehra Dun, alt. 2000 ft., also in the Nilgiri hills of South India at 6000 ft. In this country it can scarcely be called "hardy." Lord Redesdale said that it would only do for the "most favoured spots," and Mr. Bean says that it is "only suitable for the mildest parts of

the kingdom." Here, in the hills of East Hampshire, I have succeeded in keeping it alive for several years with the help of protecting branches in winter and shelter from the north winds, but the upper parts of the culms do get cut back by frost, so that the clumps, though soon recovering and looking very pretty, will probably never grow as tall as those of other species do. In S. Ireland I believe it thrives quite well as I have received specimens from Miss French, of Cuskinny, Co. Cork. Though cut back by the winter frosts it succeeded in flowering in August, 1917, in the garden of Mr. G. W. E. Loder of Wakehurst Place, Ardingly, Sussex; and near this I have seen it in the gardens at Grayswood, Haslemere and Hollycombe, W. Sussex. Mr. Bean, quoted by Dr. Stapf, says that he did not see it in any of the gardens in S. Cornwall that he visited in 1893. In a conservatory it will undoubtedly thrive, witness the fine clumps in the Temperate House at Kew which have given the flowering culms now being discussed. And there, as with other artificially-protected kinds, it gives longer culms with a greater diameter, looking so unlike the plant in its native wilds, that for some years I have had doubts whether it really was the true species.

The other three kinds of *Arundinaria* of the North-West Himalaya are much more hardy. *A. Falconeri*, which has been found as far west as the Tons river in Tehri-Garhwal, is a caespitose species of high elevation as Dr. Stapf has so fully described, is grown in many parts of this country and thrives, though it, too, as Lord Redesdale has remarked for the Midlands, may suffer in very severe winters by having its culms cut back for some distance. I keep very beautiful clumps of it as well protected by branches as I can and, more important still, try to shelter them from cold north winds, those enemies of all but the strongest of shrubs. *A. spathiflora*, Trin., is the commonest and chief species of the North-West Himalayan region and is known as the high-level Ringal, *A. falcata* being the low-level Ringal. It is also a caespitose species, but the clumps grow closely and gregariously in the underwood of the forest, chiefly of spruce and silver fir and deodar, above 7000 ft. It can be at once recognised by the tessellated nervation of the leaves and the yellowish or reddish culms, and is hardy in this country, at any rate in the Southern Districts, but it wants overhead shade and likes well-drained slopes protected from the North.

The last of the four species is *A. jaunsarensis*, Gamble, which was described from leaf and stem specimens gathered in the forest near Mundali in Jaunsar beyond Chakrata at about 7000 to 8000 ft. by Mr. U. N. Kanjieal and myself in 1891. It is at once recognisable by having single stems arising at intervals from a long underground rhizome. I am strongly of opinion that it is the same as the well-known *A. anceps*, Freeman-Mitford, which is hardy in this country and flowered in 1910 in the garden of Mr. C. H. Cave at Mangotsfield near Bristol. Lord Redesdale, in the "Bamboo Garden," p. 181, says that

FIG. 1.

1. lower portion of a stem with part of a long, very loosely flowering branch (natural size); 2. leafy branch, taken from same plant, before flowering set in (natural size); 3. portion of a blade with margin (5 x); 4. spathe (natural size).

FIG. 2.

1. inflorescence from the upper part of the same stem (natural size); 2. spikelet (4 x); 3. lower glume (4 x); 4. upper glume (4 x); 5. valve (flowering glume) (4 x); 6. valvule (palea) (4 x); 3–6 flattened out.

"it was picked up at the sale of a dead nurseryman's effects by Mr. Jordan, the Superintendent of Regent's Park, who very wisely bought the whole stock." He gives no date, however. Mr. Bean's account of it is different; he says: "introduced by Col. Edmund Smyth* from Garhwal about 1865 and first cultivated at Elkington Hall, Lincolnshire." I have also another account of its origin from the late Mr. T. W. Webber, who was in the sixties of last century a forest officer in Kumaon and whose book "The Forests of Upper India," published in 1902, is an interesting account of work, travel and sport in the Himalaya and Central India at that time. Mr. Webber wrote in May 1907 to Mr. J. W. Oliver, who sent his letter on to me some years later, as follows: "The straight, upright *Arundinaria anceps* (so named at Kew) which I sent you was from seed which I procured myself in Kumaon high up, and it has been growing in the garden here (Athy, Ireland) for 25 years. There is a clump 30 yards round. It sends out lateral suckers and spreads itself rapidly." Mr. Webber, with whom I had already got into communication myself in 1907, sent me specimens of the culms, culm-sheaths and leaves from his clump, and they were undoubtedly *A. anceps*. Mr. Webber was in Kumaon from 1861 to 1864, in which latter year it is probable that the bamboo flowered and seeded, and that Mr. Webber and others collected the seed and distributed it. I think it may be useful to put this information on record. Though I myself believe that the Kumaon *A. anceps* and the Jaunsar *A. jaunsarensis* are the same, we cannot be quite sure until flowers of the latter are available. It is to be hoped that the Forest Botanist to the Dehra Dun Research Institute will keep an eye on the plants at Mundali. The flowers of *A. anceps* are remarkable for having spikelets often 4 ins. long, with 8 to 9 flowers in each, and resemble those of some Japanese species and notably *A. japonica* and *A. Simoni*.

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* According to letters preserved at Kew, written by Colonel Edmund Smyth of Elkington Hall, Louth, Lincolnshire, and dated Nov. 16, and Dec. 18, 1898, he introduced *Arundinaria anceps* between 1862 and 1865. He says he sent a small sack of seeds to his father at Elkington and that when he came home in 1868 he found a large seed bed of plants there about one foot high growing quite vigorously; some of these were distributed amongst various friends. Colonel Smyth observes that the seed was gathered for him by a native official of Joshimuth, in British Garwhal.

XXXVIII.—DECADES KEWENSES

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS CIV.

1031. Berberis Lamberti, *Parker* [Berberidaceae-Berbereae]; affinis *B. Jaeschkeanae*, C. K. Schn., var. *Usterianae*, C. K. Schn., sed foliis duplo majoribus integerrimis, pedunculis pedicellisque longioribus.

Frutex nanus, 6–7·5 dm. altus, ramulis junioribus leviter angulatis glabris, pallide flavis; spinae 1–3-fidae, graciles, 1–1·5 cm. longae. *Folia* fasciculata, lineari-oblanceolata, integerrima, apice pungentia, basi attenuata, sessilia, utrinque glabra, integra, subtus pallida vel fere alba, non papillosa, margine involuta, 2–2·5 cm. longa, 4–7 mm. lata, nervis lateralibus paullo prominulis. *Inflorescentia* subumbellata vel brevissime racemosa; pedunculus 1·5–4 cm. longus; pedicelli 0·5–1·3 cm. longi, basi bracteis minutis ovatis suffulti. *Petala* et *sepala* ignota. *Fructus* 1 cm. longus, ovoideus, ruber, stylo nullo. *Semina* 2–5, ovoidea, brunnea, eleganter lacunosa.

India. N.W. Himalaya: Almora; Humdhura and Ratapani, 2500–2800 m., *W. J. Lambert.*

Apparently a rare species; Mr. Lambert, Deputy Conservator of Forests, Almora, says he has only seen it in the above two places. In leaf this species resembles *B. Osmastonii*, Dunn, but the leaves are rather larger, not so rigid or so white beneath and in *B. Osmastonii* they are densely papillose beneath.

1032. Rinorea Hummelii, *Sprague* [Violaceae]; a ceteris speciebus centrali-americanis inflorescentia composita recedit.

Arbor mediocris. *Ramuli* graciles, annotini cinerei, conspicue lenticellati, circiter 2 mm. diametro; ramuli hornotini viriduli, minute patule pubescentes, 2–4·5 cm. longi, duo paria foliorum gerentes, inflorescentia terminati. *Folia* opposita; petiolo 3–5 mm. longi, supra canaliculati, minute pubescentes; lamina obovata, apice acute acuminata, basi breviter subcuneata, 6–13 cm. longa, 2·5–6·5 cm. lata, acumine 0·6–1·2 cm. longo, subintegra denticulis minimis hinc inde sub lente valida tantum visis, chartacea, discolora, supra praeter nervum medium minute furfuraceo-pubescentem glabra, nervo medio et lateralibus tertiariisque prominulis, subtus glabra, lucidula, rete venularum etiam prominulo areolis dense pallide punctatis; nervi laterales utrinque 7–8, patuli, arcuato-ascendentes. *Racemi* compositi, ramulos hornotinos terminantes et in ramulis annotinis ex axillis foliorum delapsorum orti, 1·5–3 cm. longi, breviter patule pubescentes; rhacheos rami patuli, inferiores usque ad 5-flori; bracteae deltoideae, 1 mm. longae, extra pubescentes, ciliolatae; pedicelli 2 mm. longi. *Sepala* anthesi patentia, late ovata, breviter cuspidata vel apiculata, 1–1·2 mm. longa, 1–1·1 mm.

lata, minute ciliolata. *Petala* lanceolata, obtusa, 4·5 mm. longa, 1·75–2 mm. lata, superne revoluta. *Filamenta* subquadrata, 0·5 mm. longa, 0·6 mm. lata, collo angusto 0·1 mm. longo cum anthera connexa; connectivum anguste lanceolatum, 3 mm. longum, 1–1·1 mm. latum, usque 0·3–0·4 mm. infra apicem antherae adnatum; antherae ovatae, apice minute biapiculatae, 1·5 mm. longae, 0·8 mm. latae. *Ovarium* globosum, 1 mm. diametro, fulvo-velutinum; ovula 2 pro placenta; stylus 3 mm. longus triente inferiore patenter piloso ceterum glaber.

British Honduras. Salt Creek, *Hummel*.

According to Mr. Hummel, this species is a tree of fair size, locally known as "Wild Coffee." The young plants are often mistaken for Mahogany seedlings or saplings.

1033. Gymnosporia Championi, *Dunn* [Celastraceae-Celastreae]; quoad pubescentiam strigulosam *G. puberulae*, Laws., affinis, sed inflorescentia condensata et foliis basi rotundatis diversa.

Frutex robustus, sparse armatus; rami ut folia petioli pedunculique asperuli, cortice rubro-brunneo rugoso. *Folia* ovata, apice rotundata vel nonnunquam obtusa, raro acuta, basi truncata vel rotundata, 5–6 cm. longa, 3·5–4·5 cm. lata, chartacea, pilis brevissimis strigosis utrinque asperula, nervis lateralibus utrinque 10–14, subtus reticulata, margine crebre crenato-serrulata; petioli 3–4 mm. longi. *Cymae* paucifloræ, foliis circiter triplo breviores; bracteae bracteolaeque scariosae, minutae; pedicelli graciles, 0·3–1 cm. longi. *Sepala* 5, 1 mm. longa, minute ciliolata. *Petala* 5, oblonga, obtusa, 3 mm. longa, 2 mm. lata. *Stamina* petalis breviora, glabra. *Discus* conspicuus, glaber. *Ovarium* 2 mm. altum, glabrum; stylus brevis; stigmata 3, patentia; loculi 3; ovula in quoque loculo 2, erecta. *Capsula* 5–6 mm. alta, complanata; valvae 3, apice dehiscentes, transverse rugosae. *Semina* matura non visa.

India. United Provinces; Ramnagar Division, *H. G. Champion*.

1034. Uraria pulchra, *Haines* [Papilionaceae-Hedysareae]; *U. Lacei*, Craib, et *U. paniculatae*, C. B. Clarke, affinis, ab illa habitu tenuiore, indumento, pedicellis multo longioribus, ab hac foliolorum forma, pedicellis longis differt.

Suffrutex subdiffusus, 9–12 dm. altus, ramis pilis fulvis longis et praeterea breviore indumento tectis. *Folia* 3-foliolata, stipulis subulatis setaceis 7–9 mm. longis. *Foliola* oblonga vel elliptico-oblonga, plerumque paulum obovata, apiculata, 7·5–11·5 cm. longa, subtus pilis fulvis parce instructa, basi rotundata, apice admodum rotundata, nervis lateralibus utrinque 7–11 ad marginem pertinentibus. *Flores* albi vel subcaerulei, 1–2-nati, 1 cm. longi, in racemos laxos paniculatos glandulosos 15–40 cm. longos dispositi, pedicellis gracillimis 1·2–1·6 cm. longis. *Calyx* corollae concolor, paucis pilis tenuibus instructus, demum glabrescens, dentibus superioribus fere connatis. *Carina* 1 cm.

longa. *Filamenta* quatuor alternantia breviora, anguste clavata, antheris in exemplaribus nostris destituta. *Ovarium* pilosum; styli parte superiore crassa. *Legumen* pilis glandulisque tectum. *Semina* 5–7.

India. Behar and Orissa; Sameshwar Hills, on the borders of Nepal, *Haines* 3962.

1035. Acacia hydaspica, *J. R. Drumm. MSS. ex Parker* [Leguminosae-Mimoseae]; ab *A. Campbellii*, Arn., ramulis glabris, foliis paucijugis, foliolis leguminibusque majoribus inter alia distincta.

Frutex 1–2 m. altus, ramulis tenuibus glabris, aculeis 1–3 cm. longis rectis eburneis tenuibus. *Folia* 1–4-juga, rachi (petiolo incluso) usque ad 3·5 cm. longa, basi et saepe infra jugum distale glandula orbiculata sessili instructa vel eglandulosa; pinnae 0·5–2 cm. longae; foliola utrinque 4–12, 2·5–4 mm. longa, oblonga, subacuta, basi obliqua, utrinque glabra, nervulis obscuris. *Capitula* axillaria, solitaria vel bina, lutea, 1–1·2 cm. diametro; pedunculi 1–1·6 cm. longi glabri; bracteae 3, ovatae, connatae, 2 mm. longae, supra vel infra medium pedunculi insertae. *Calyx* vix 2 mm. longus, glaber, dentibus minutis. *Corolla* 3·5 mm. longa, glabra, lobis triangularibus minutis ciliolatis. *Stamina* numerosissima, filamentis glabris. *Legumen* 10–15 cm. longum, 7–8 mm. latum, stipitatum, glabrum, suturis parum incrassatis, inter semina leviter constrictum. *Semina* 5–9.

N.W. India. Attock, *Griffith* 1921; Peshawar to Jhelum, *Stewart* 106, 313; Salt Range, *Aitchison* 434, *Drummond* 13,834, 14,564.

Common west of the Jhelum on dry rocky ground. I have not seen this plant in the Punjab plains to the south and east of the Salt Range. It occurs up to about 1000 m. in the foothills of the Himalaya in the Rawalpindi and Hazara districts where it is called by the natives *kikri* or sometimes *babuli*, the diminutives of *kikar* or *babul*, (*Acacia arabica*. Willd.). When not in flower or fruit it might easily be taken for an unhealthy *A. arabica* seedling.

1036. Spiraea diversifolia, *Dunn* [Rosaceae-Spiraeeae]; *S. hypoleucae*, Dunn, affinis, sed foliis surculorum sterilium orbicularibus palmatifidis et inflorescentiis glabris differt.

Frutex ramosus, ramulis gracilibus cortice brunneo-rubro. *Folia* ramorum floriferorum obovata, apice obtusa, trilobata, basi acuta, 2–3 cm. longa, subtus alba, papyracea; petioli 0·5–1 cm. longi; folia surculorum sterilium diversa, circumscriptione orbicularia, in lobos 3 obtusos crenatos profunde palmatim divisa, 4–5 cm. diametro, subtus alba. *Fructuum* pedicelli graciles, 1·5–2 cm. longi, ut fructus glabri, circiter 20 in nodis fasciculati vel paulo racemosi. *Calyx* urceolatus, 2 mm. longus; dentes late triangulares, 1·5 mm. longi, tandem decidui. *Petala* et *stamina* non visa. *Carpella* 5–6, glabra, 2–3 mm. longa.

India. United Provinces: East Almora; Hum and Ralapani, 3000 m., 20. 10. 20., *W. F. Lambert.*

1037. Rubus almorensis, *Dunn* [Rosaceae-Rubeae]; a *R. nutante*, Wall., foliis subtus molliter hirsutis, terminali sessili et stipulis pectinatis differt.

Suffrutex inermis. *Caules* prostrati, debiles, ut petioli pedicelli et calyces breviter tomentosi, sparse setosi; vetusti lignosi. *Folia* ternata vel versus fines ramorum nonnunquam 3-lobata; petioli 4–6 cm. longi; stipulæ liberae, ovatae, profunde pectinatae; foliola sessilia, lobulata, rugulosa, argute serrulata, obtusa vel acuta; terminalia rhomboideo-ovata, basi cuneata, 5–7 cm. longa, 4–5 cm. lata; lateralia obliqua, basi rotundata. *Paniculae* parvae, terminales. *Florum* pedunculi 2–3 cm. longi, bibracteati. *Calyx* 2–2·5 cm. diametro; dentes lanceolati, acuminati, apice foliaceo-incisi. *Petala* alba, 1 cm. longa, late obovata. *Achenia* circiter 6, rubra, sapidissima.

India. United Provinces: Almora; Ramganga below Wimakpani, 2700 m., 9. 10. 20., *W. J. Lambert.*

The discoverer, after making a careful investigation on the spot, thinks that the plant may be a hybrid between *R. nutans*, Wall. and *R. reticulatus*, Hook. f., both of which are common in the district.

1038. Jasminum strictum, *Haines* [Oleaceae-Jasmineae]; *J. Wightii*, C. B. Clarke, affinis, habitu erecto, petiolis brevioribus, foliis angustioribus sed minus acuminatis, calyce pubescente vel puberulo differt.

Suffrutex caulibus ex radice perenne 2–3 erectis strictis 3–6 dm. altis minute-puberulis. *Folia* lineari-lanceolata vel oblongo-lanceolata, sensim acuminata, suberecta, glabra, subtus glandulosa, margine incrassato, nervis lateralibus 8–10 tenuibus; petioli 3–5 mm. longi, articulati. *Cymae* puberulae, circiter 3–5-florae, terminales et ex supremis axillis, pedunculis 0–2 cm. longis suffultae. *Bracteae* setaceae. *Calyx* campanulatus, plus minusve pubescens; tubus 2 mm. longus; dentes inaequales, erecti, lineares, 1–3 mm. longi. *Corolla* alba; tubus 0·9–1·2 cm. longus; lobi 6–10, paulo longiores, lineares, acuminati. *Fructus* non visus.

India. Plateau of Chota Nagpur; 900 m., *Haines* 4312.

1039. Ervatamia caudata, *Gamble* [Apocynaceae-Plumerieae]; *E. Heyneanae*, T. Cooke, affinis, corollae lobis dextrorsum, nec sinistrorsum ut in forma sylvestri Indiae septentrionalis *E. coronariae*, Stapf, obtegentibus, foliis minoribus longissime caudatis et aliis notis differt.

Frutex erectus, ramulis gracilibus pallidis. *Folia* siccitate tenuia, elliptico-obovata, apice longissime caudato-acuminata, basi in petiolum attenuata, glabra, infra pallida, 10–15 cm. longa, 3–5 cm. lata, nervis primariis utrinque 8–12 regularibus marginem versus arcuatis; petiolus circiter 1 cm. longus. *Flores* albidi in cymis 1–2 corymbosis terminalibus dichotomis patentibus;

pedunculi ad 5 cm. longi; pedicelli graciles. *Calycis* tubus glaber brevis, lobis ovatis ciliatis intus glandulosis. *Corollae* tubus gracilis, circiter 2 cm. longus, paullo supra mediam partem incrassatus; lobi ovato-oblongi, dextrorsum obtegentes, sinistrorsum torti, in alabastro fere globosi, margine ciliati, ad 2 cm. longi. *Stamina* inclusa, corollae tubi paullo supra mediam partem affixa, lanceolata, mucronata, filamentis brevissimis. *Stylus* gracilis, supra incrassatus, apiculo bifido. *Folliculi* ovati, 3 cm. longi, longe acuminati, seminibus verosimiliter paucis. *Semina* oblonga, 1·2 cm. longa, postice striata, antice canaliculata, cotyledonibus ovatis.

South India. Anamalai Hills; Udumanparai, *Barber* 5759; at Manamboli, 1200 m. alt., *Fischer* 3378; Hills of Tinnevelly, 700–900 m. alt., *Wight*, *Beddome*, *Barber* 372, *Hooper* and *Ramaswami* 39,408, in evergreen forest.

1040. Petastoma Broadwayi, *Sprague et Riley* [Bignoniaceae-Bignonieae]; calycis forma simile *P. leucopogoni*, Bur., a quo partium fere omnium glabritie, pseudostipulis angustis falcatis, pedicellis apice (seu calyce basi) lepidotis, calycis lobis brevioribus late rotundatisque differt.

Frutex scandens. *Ramuli* multicostulati, juniores lepidoti, seniores fulvescentes, densiuscule lenticellati lenticellis concoloribus, glabrati, nodis dilatatis; internodia 10–15 cm. longa. *Folia* cujusque paris linea pilosa connexa, cirrho terminali caduco bifoliolata; petiolus 1·5–2 cm. longus, apice valde dilatatus, supra praeter basin apicemque pilis erectis valde hirsutus; petioluli 1–2 cm. longi, supra per totam longitudinem valde hirsuti; foliola ovata vel elliptico-ovata, apice acuminata, basi obtusa rotundata vel subcordata, 10–16 cm. longa, 5·5–9 cm. lata, acumine 1·5–2·5 cm. longo, supra juventute sparse lepidota mox glabra, densiuscule manifeste reticulata, subtus in axillis nervorum lateralium fasciculato-pilosa, secus nervos hinc inde sparse patenter pilosa, ceterum glabra, nervis prominentibus, venulis prominulis; nervi laterales utrinque 5–6; pseudostipulae foliaceae, falcatae vel acinaciformes, 1–1·5 cm. longae, subtus pilis majusculis curvatis sparse indutae. *Thyrsi* 2·5-3 dm. longi, inferne foliati, ramis lateralibus patentibus vel patulis pedunculis propriis 3–8 cm. longis; bracteae lineares vel subulatae, 1–5 mm. longae; pedicelli 5–9 mm. longi, sparse lepidoti, apice in basin calycis obconico-incrassati, densiuscule lepidoti. *Calyx* inflato-campanulatus, 7 mm. longus, breviter lobatus, extra pilis curvatis sparse puberulus; lobi late rotundati, 0·75 mm. longi, 3·5 mm. lati. *Corolla* campanulato-infundibularis, 4–5 cm. longa; tubus basalis circiter 1 cm. longus; fauces 2–2·5 cm. longae; lobi 1–1·5 cm. longi. *Stamina* apice tubi basalis inserta, ad et infra insertionem pilis glandulari-capitatis breviter villosa; filamenta longiora 2 cm., breviora 1·5 cm. longa; antherarum lobi divergentes, 2·5–3 mm. longi. *Staminodium* 4 mm. longum. *Discus* pulvinaris, superne medio leviter excavatus, 1·2 mm. altus. *Ovarium* 3 mm. longum,

0·75 mm. diametro, glabrum, olivaceum. *Stylus* 3 cm. longus; stigmata obovato-oblonga. *Ovula* pro loculo biseriata, circiter 20 pro serie. *Capsula* (immatura tantum visa) circiter 3 dm. longa, 1 cm. lata.

West Indies. Trinidad: St. Clair; Knapp Hill, Aug. 1911, *Broadway* 4164 (type); and without precise locality, *Fendler* 517.

Petastoma Broadwayi is the first species of *Petastoma* recorded from the West Indies. It agrees with *P. leucopogon* in the general shape of the calyx, but differs in most other respects, and does not appear to be nearly related to any of the species hitherto described.

XXXIX. THE FLORA OF MADRAS: IV.

The fourth part (pp. 579–768), *Rubiaceae* to *Sapotaceae*, and part of the *Ebenaceae* of the Flora of Madras, has now been published, and the following notes have been drafted by Mr. Gamble. We are indebted to him for the opportunity of placing these on record for the information of workers in herbaria, relative to conclusions with regard to particular species dealt with in the work that differ from those arrived at by earlier writers.

Notes on the Flora of Madras.*

J. S. Gamble.

Rubiaceae. *Oldenlandia.* I have thought it best to follow other botanists and especially K. Schumann in the "Natürliche Pflanzenfamilien" in placing *Hedyotis* under *Oldenlandia* owing to the difficulty in finding characters to keep them separate.

Mussaenda. The rearrangement of the species of this genus follows that which Mr. J. Hutchinson has made in the Kew Herbarium. Mr. Hutchinson kindly placed at my disposal his draft of a Key to the S. Indian and Ceylon species and this has been followed in the main.

Randia. R. dumetorum, Lamk. As a Forest Officer in India I was much puzzled over this species especially after the appearance of Part vii (Vol. iii) of the "Flora of British India." The first form of it whose acquaintance I made about 1873 was a small tree very common in the Sál forests and mixed forests of the Darjeeling Terai. It had thin obovate leaves often 4 to 5 in. long and an apple-like fruit used by the Mechis and Garos and other forest residents for poisoning fish. In forest shade, the spines were usually small and thin, but I remember that they were longer and thicker when the tree was found in open places. I have seen the same form in the

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* Previous notes were published in the *Bulletin* for 1916, p. 57, for 1918, p. 222, and for 1920, p. 49.

Sál forests of Dehra Dún and the Siwaliks in the United Provinces, and it extends to the forests of Chota Nagpore and further south to those of Ganjam. There is a specimen collected by Mr. H. H. Haines in the Chanda forests of the Central Provinces at Kew. The late Mr. A. W. Lushington sent me leaves of it collected at Ukroba in the Madgol hills of Vizagapatam at 3000 ft. and I think this must be its southern limit at any rate on the eastern side of the Peninsula. I think there can be very little doubt that it is *Posoqueria longispina*, Roxb. (*Randia longispina*, DC. & W.& A.) figured in Roxburgh's drawing No. 1379 from which Wight's No. 582 was copied, but I must confess that some points of the figures and descriptions do not quite agree with the specimens. The calyx-lobes, for instance, in my Darjeeling Terai specimens are narrow and linear-lanceolate, about ·2 in. long and the slender pedicels reach nearly half an inch, but there is considerable variation in both, so that I think I can consider that the little tree of the Sál forests is *Randia longispina*, DC. for the purposes of the "Madras Flora."

When in 1882, I went to the Madras Presidency, I soon came across a *Randia* of quite different aspect common in the dry thorny scrub forests of the Districts bordering on the East Coast from the Kistna river to Madras. It is a stiff little tree or shrub with strong thorns in pairs, many white flowers turning yellow and small obovate, rather thick leaves rarely more than 1 in. long. This seems to me to be undoubtedly the plant described by Lamarck and figured by him, and it is well represented in Roxburgh's drawing No. 136 and Wight's No. 580. It seems to be the true *Randia dumetorum*, Lamk. It is a small tree or shrub with grey bark and hard close-grained wood and it is found all along the Eastern Coast and inland in the Deccan and Carnatic, extending probably northwards in dry localities, perhaps even to the Ganges. In the scrub forests near the coast the leaves are more or less glabrous, but inland, in the thicker forests of the scarp of the Deccan plateau, they are often quite tomentose. Near the Coast, indeed usually on the Coast sands, is found a form with rather smaller leaves and more fascicled flowers, with slender spines. I feel sure that this is *Posoqueria floribunda*, Roxb. (*Randia floribunda*, DC.) figured in Roxburgh's No. 2198, copied in Wight's Icones as No. 583. But it is scarcely more than a variety of *R. dumetorum*, and it seems to me that *Posoqueria nutans*, Roxb. (Roxburgh Fig. No. 2199—Wt. Ic. t. 581) which was described from a plant cultivated in the Calcutta Botanic Garden is really only *Randia dumetorum* cultivated in a moister climate.

Randia tomentosa, *W. & A.* 388, is only definitely represented at Kew by two very imperfect specimens, both probably from the same gathering, viz.: Wt. Colln. No. 1277 and Wallich Colln. No. 8264A (Herb. Wight & Dindigal) collected by Wight "in dry jungle about 1800 ft. above the sea." The two look

as if they were of the same collecting. The leaves are elliptic-obovate, 1·5–2 in. long and 1–1·5 in. broad, densely softly tomentose beneath, with about 8 pairs of strongly marked nerves, and the fruit is about 1 in. in diameter. Specimens almost exactly matching those of Wight have recently been collected by Dr. Barber at Kollimalai in Trichinopoly (No. 11364) and Hassanur in Coimbatore (No. 10534), and these and other specimens in the Madras Collection which has been lent to me, and the Bourne Collection presented to the Kew Herbarium, belong all to Wight and Arnott's *tomentosa*, I think. In his "Indian Trees," Sir D. Brandis did not mention *R. tomentosa*, W. & A., but he remarked as follows under *R. dumetorum* regarding a form apparently found all down the Western side of the Peninsula: "A remarkable form, possibly a distinct species, with leaves densely velvety beneath, hairy above, secondary nerves prominent, 10–12 pairs, fruit ribbed and crowned with the semi-persistent calyx-lobes. Sattara Ghâts and Mahabaleshwar (D.B.), Sigúr Ghát, Nilgiris (Gamble) is similar to *R. tomentosa*, Bl. of Burma." I think he should have said—"agrees with *R. tomentosa*, W. & A." for *R. tomentosa*, Bl. is clearly quite distinct. After spending considerable time over this question, I have come to the conclusion that almost the whole of the material in the Kew and other Herbaria from the W. Ghâts and Coasts belongs to this species, which is quite distinct from *R. dumetorum*, Lamk.

The species is perhaps more closely related to *R. longispina*, DC., though clearly distinct. As the name *tomentosa* is already occupied, another must be found, and I have called it *R. Brandisii*. The following are the specimens which I consider belong to it:—

Bombay Presidency. Mahabaleshwar Hills (Stocks); Kala Nuddi (Ritchie 346), both in Herb. Kew.

Madras Presidency. Hills near Mangalore, S. Canara (Hohenacker 125, 861); Mysore and Carnatic (G. Thomson); Cochin (Mr. Johnstone); Nilgiris (Wight K.D. 1316); Bolampatti near Coimbatore (Wight K.D. 1317); Ayamallay (Wight K.D. 1319); Anamallai (Wight 1320); also without locality Wight Hb. Propr. 1276, 1277; Dindigul (Wallich 8264A); Pulney Hills (Bourne 978, 1341 and 2337) all in Herb. Kew. Courtallum (Wight—no number); Ayalhatti (Meebold 8996); Nilgiris and Bangalore (H. Cleghorn) all in Herb. Edinb.

Coonoor Ghát Nilgiris (M. A. Lawson); Jahlsur, S. Canara (Barber 2435); Hassan to Barguai, Mysore (Barber 7041); Kollimalai Trichinopoly (Barber 11064); Hassanur, Coimbatore (Barber 10534); Kuppam river, Taliparamba, Malabar (Barber 8792); all in Herb. Madras.

Yedawan, Travancore (Vencoba Row 2878) in Herb. Trav. Sigúr Ghát, Nilgiris, 4000 ft. (Gamble 14506); Bellary (H. Brougham) both in Herb. Gamble.

It will thus be seen that I have divided up into 3 species the plants collected together in the Flora of British India under *R. dumetorum*, viz.: No. 1 *R. dumetorum*, Lamk. a stiff shrub or small thorny tree of the dry, scrub forest of the Eastern side of the Peninsula; No. 2 *R. longispina*, DC. a small tree of the N. Indian Forests extending southwards to the Godavari, and No. 3 *R. Brandisii*, Gamble, a small tomentose tree of the Western side of the Peninsula only.

Lasianthus. Like most of those who have had to deal with this genus I have found it difficult, but Dr. Wight's paper in the Calcutta Journal of Natural History vi (1846) p. 494 has been a great help. I have had, however, to leave several specimens in different Herbaria unidentified. The three species *L. strigillosus*, Hook. f., *L. acuminatus*, Wt., and *L. parvifolius*, Wight have been the most difficult, and with them it has been necessary to ascertain exactly what is the *L. coffeoides* described by P. Fyson in the Kew Bulletin for 1914, as no specimens were available that had been written up by the author. I think, however, that I have correctly judged which of the two specimens on the same sheet that Wight included in his *L. acuminatus* is Fyson's plant, and the excellent Bourne and Saulière specimens will now well represent the species. I wish, however, here to put on record the suspicion that *L. coffeoides* may prove to be only a form of *L. strigillosus*, to which I think it is nearer than it is to *L. acuminatus*.

Compositae. *Anaphalis.* The distinctions between the genera *Anaphalis*, *Gnaphalium* and *Helichrysum* are not very easy to make out, at any rate in dry specimens. This was commented on by Sir J. D. Hooker in the Fl. Br. Ind. iii. 279, and the subject was more fully discussed by Mons. G. Beauverd of the Herbier Boissier in the "Bulletin de la Société Botanique de Genève" 2me. Série, Vol. v. p. 146 (1913) who therein announced an early monograph of the genus *Anaphalis*. Pending the publication of the promised monograph, it has seemed best to adhere as nearly as possible to the arrangement of the Flora of British India. There is, however, one species which requires some explanation, namely, No. 14 *A. oblonga*, DC.

In the "Contributions to the Botany of India" by Dr. Wight (1834) Mons. A. P. de Candolle described two species of *Gnaphalium*, *G. subdecurrens* and *G. ellipticum*, both of which have been included under *Anaphalis oblonga* in the Flora of British India. In 1837, in Vol. vi of the "Prodromus," Mons. de Candolle published his species *A. oblonga* based on a specimen collected in the Nilgiri Hills by Leschenault, and this has been taken as the specific name under which Mons. de Candolle's two Gnaphaliums should be placed. But it seems to me that the earliest specific name is not *A. oblonga* but should be *A. subdecurrens*, and this is the name I have adopted. *Gnaphalium subdecurrens*, DC. was based on Wight's No. 1469 (Herb. propr.) of which there are specimens at Kew in two forms, one as a low

tufted plant evidently and as I can recollect of dry open downs at high elevations, the other a more elongated plant of lower elevations, but belonging, I think, to the same species. What the true *A. oblonga*, DC. is, I am not quite sure, but the description seems to me to agree well with the latter form. In my opinion, *A. elliptica*, DC. Prodr. vi. 274, which is *Gnaphalium ellipticum*, DC. in Wt. Contrib. 21, is a distinct species instead of being a variety, as Hooker made it, of *A. oblonga*, and the other variety *Lawii* is also, I think, distinct, and I have considered it as such in the "Flora of the Madras Presidency."

XL. MISCELLANEOUS NOTES.

The Earl of Ducie, P.C., G.C.V.O., F.R.S., F.G.S., F.L.S.—The death of this veteran arboriculturist in his 95th year will be much regretted by all who knew him. He was the father of the House of Lords, for a very long period the Lord Lieutenant of Gloucestershire and a Vice-President of the Royal Horticultural Society, and in my judgment the best tree-planter in Great Britain. His love of trees began when he was a comparatively young man, succeeding his father 68 years ago to the ownership of Tortworth Court, the most beautiful and one of the best managed estates in the Vale of Gloucester. He at once began to plant not only conifers, which were then the fashion, but all the hard-wood trees which he could procure. Many others have done this, but none have, as far as I know, realised to the same degree that it is not enough to plant a tree unless it is cared for afterwards, and up to the last year or two of his long life he had no greater pleasure than the tending and careful pruning of the trees he had planted. The result is that the trees at Tortworth are now models of good cultivation which can be matched only in the Kew Arboretum.

When I began to study the Trees of Great Britain, no one gave me more help and encouragement than Lord Ducie, and no other place in England has contributed so much to my knowledge. He enjoyed nothing better than a walk round his trees with anyone who was interested, and, being an active man even when past 80, he was always pressing on to more discoveries in his numerous plantations, to which there seemed to be no end.

When Professor Sargent and the late Professor Asa Gray visited Tortworth together many years ago, he was able to show them three trees of the Pacific States which neither of them had seen in their native country, and which will not live in New England, and the Chilean "Beech" (*Nothofagus obliqua*), raised from a seed which I brought home in 1902, now nearly 40 feet in height, was a source of unfailing pleasure to him to show visitors. His generosity in distributing from his stock to those interested in arboriculture was only exceeded by his love for his trees.

Though many of his friends, among whom his only son the late Lord Moreton, Professor Sargent and Mr. Vicary Gibbs were foremost, pressed him more than once to allow an illustrated catalogue of his life's work to be prepared, he never would consent to it, and it is much to be desired that such a catalogue may now be made as a memorial of a man whose sense of duty to his county, his country and his neighbours was so strong and so consistently followed up in his daily life.

H. J. ELWES.

I spent a few hours at Tortworth in May, 1915, in company with Lord Ducie, and a brief account of some of the more interesting trees appeared in the *Kew Bulletin* for that year (p. 298). Probably the most famous tree at Tortworth is the golden chestnut of California (*Castanopsis chrysophylla*). It was planted by Lord Ducie about 1855, and when I measured it in 1915 it was 30 feet high and 3 feet 7 inches in girth of trunk. It has always been the finest tree in England and, having borne fertile seeds for nearly thirty years past, is the parent of many trees in gardens now, including most of those at Kew.

Lord Ducie was one of the few amateurs of the present time who took an interest in and planted oaks, and Tortworth in consequence possesses a number of rare trees unrivalled elsewhere in size and development. Amongst them may be mentioned *Q. macedonica*, *Q. Kelloggii*, *Q. glauca*, *Q. conferta*, *Q. Mirbeckii*, *Q. imbricaria* and *Q. Aegilops*. A tree in which Lord Ducie took great interest was the true *Juglans rupestris*, a very elegant walnut from the S.W. United States, rare in English gardens and nowhere so fine as at Tortworth. Of conifers Lord Ducie had a splendid general collection, admirably grown, and of the rarer species his *Pseudolarix Fortunei* and *Torreya californica* are particularly noteworthy.

For many years Lord Ducie was the doyen of tree cultivators in the British Isles, and even in Europe there was only one whose length of experience approached his—Mr. Gaston Allard, of Angers, who died in January, 1918.

W. J. B.

Miss Matilda Smith, Artist in the Herbarium, retired from the public service on 29 July, 1921, in conformity with the regulations prescribed for members of the Civil Service. The devotion to duty which has marked Miss Smith's tenure of her post during the past twenty-three years has placed Kew under an obligation it is not easy to assess. Moreover, the labours of Miss Smith, as an official member of the Herbarium staff, constitute but a small portion of her services to this institution.

When in 1878 the late Mr. W. H. Fitch (*K.B.* 1915, p. 277), gave up his work in connection with the *Botanical Magazine*, the editorship of which was part of the duty of the Director, the late Sir Joseph Hooker was under the necessity of endeavouring

to secure the services of a competent successor. As a temporary measure Lady Thiselton-Dyer, with much public spirit, came to her father's assistance and supplied drawings for the *Magazine* during the period 1878–83. But the task of finding a permanent artist for this important serial, capable of rendering the service required and willing to do so in return for the pittance which public opinion forty years ago regarded as an adequate remuneration for work of a scientific character, was no easy matter. Sir Joseph learned that Miss Smith, a niece of Lady Eastlake and therefore a cousin, thrice removed, of his own, was endowed with a natural taste for plant-portraiture and had already acquired considerable skill in this branch of art. Sir Joseph was fortunately able to persuade Miss Smith to come to Kew where, from 1878 onward, he trained her himself to make and draw floral dissections.

If Miss Smith was fortunate in having so competent a teacher, the latter was to be congratulated in finding so apt a pupil. From 1881 onwards Miss Smith became artist and lithographer, at plate 1354, for the *Icones Plantarum*, a serial prepared under the superintendence of the Herbarium staff and edited by the Director. Two years later Miss Smith became also artist for the *Botanical Magazine*, her work for which began with plate 6386.

In addition to this work for the *Icones Plantarum*, performed on behalf of the Bentham Trustees, and for the *Botanical Magazine*, executed on behalf of the publishers of that journal, Miss Smith has prepared, since she first began her duties at Kew, many coloured portraits of living plants and drawings from herbarium specimens for the herbarium collection, as well as numerous figures to illustrate taxonomic and floristic botanical works and papers.

Though Miss Smith thus became an essential and integral element in the institution, it was not until twenty years after her response to Sir Joseph Hooker's invitation that her existence was recognised officially. As from 1 April, 1898, Miss Smith, on the recommendation of Sir W. T. Thiselton-Dyer, was appointed Artist in the Herbarium under an arrangement which left her relationship with the Bentham Trustees and the *Botanical Magazine* unaffected and still permitted her to prepare illustrations for botanical work issued independently.

Though in the technical sense of the term Miss Smith has thus been a Civil Servant for rather less than a quarter of a century, her loyal and single-minded devotion to botanical science as the Artist at Kew covers a period of forty years. Miss Smith carries with her on her retirement the sincere hope of her former colleagues that she may be long spared to enjoy the leisure she has so fully earned.

Miss Smith was elected an Associate of the Linnean Society on November 3rd, in recognition of her services to Botanical Science.

Mr. Arthur Kellett, for seven years Artist and Photographer on the staff of the Ministry of Agriculture, Dominion of Canada, and during the war a member of the Royal (Canadian) Air Force, has been appointed by the Minister of Agriculture and Fisheries, as from 19 September, 1921, Artist in the Herbarium at Kew, in succession to Miss M. Smith.

Major Kenneth William Braid, B.A. (Cantab.), B.Sc. (Aberd.), A.I.C., has been appointed by the Minister of Agriculture and Fisheries, as from 3 October, 1921, an Assistant in the Herbarium at Kew.

Mr. A. H. Kirby, B.A., Assistant Director of Agriculture, Southern Nigeria (*K.B.*, 1913, p. 125), has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Director of Agriculture, Mr. O. E. Whitehead a District Agricultural Officer, and Mr. A. R. Hildebrand, Plant Import Inspector, in the Department of Agriculture, Tanganyika Territory.

Mr. T. H. Marshall, formerly Seed Collector in the Royal Botanic Gardens, Kew, has been appointed Head Gardener, Dar-es-Salaam, Tanganyika Territory, on the recommendation of the Director of Agriculture, Uganda.

Mr. F. Ashby, Microbiologist in the Agricultural Department, Jamaica, has been appointed by the Secretary of State for the Colonies Mycologist in the Imperial Department of Agriculture for the West Indies.

The following appointments in the Department of Agriculture, Trinidad, have been made by the Secretary of State for the Colonies, on the recommendation of Kew :—

Mr. A. G. Bailey, B.A., formerly a member of the gardening staff of the Royal Botanic Gardens, Kew, Economic Botanist; Mr. F. Stell, Mycologist in the Department of Science and Agriculture, British Guiana (*K.B.*, 1919, p. 447), Mycologist, Trinidad.

Alpine Plants on Snowdon.—For some considerable time Mr. A. K. Bul'ey, of Ness, Neston, near Birkenhead, has been anxious to ensure that the experimental cultivation of Alpine plants from all parts of the world might be attempted in some suitable spot in England or Wales where the conditions approach those in which such plants grow naturally. The experiment is desirable as a concomitant of the corresponding attempt arranged for in the Highlands of Scotland by the Regius Keeper of the Royal Botanic Garden, Edinburgh.

After consultation with the Director of Kew, Mr. Bulley came to the conclusion that the general locality most suitable for the purpose is Snowdonia. Having further discussed the project with Professor Farmer, F.R.S., whose knowledge of Snowdonia is unrivalled, and after visiting and carefully inspecting the range in person, Mr. Bulley resolved to adopt the suggestion of Professor Farmer as to the piece of ground on Snowdon to be used. Through the kindness of the Vaynol Trustees, permission to undertake the experimental cultivation of Alpine plants on this piece of ground has been granted, and on 24 September last the Director and Mr. W. Irving were indebted to the courtesy of Mr. Bulley for the opportunity of being present at and taking part in the initial planting of a certain number of Alpine species and the sowing of a certain number of seeds of high-level plants.

The Flora of Madras.*—We welcome the appearance of the fourth part of Mr. Gamble's Flora of the Presidency of Madras. This part deals with the families *Rubiaceae* to *Sapotaceae*, and also includes the *Ebenaceae* as far as the description of the genus *Diospyros*; the key to the species of this genus and their enumeration will begin the fifth part of the work. Brief descriptions of several new varieties are published, and we notice the following new specific names or new combinations:—*Oldenlandia nitida*, *O. caerulea*, *O. articularis*, *O. sisaparensis*, and *O. albonervia*, for species transferred from *Hedyotis*; *Mussaenda glabrata*, *M. laxa*, and *M. hirsutissima*, species founded by Mr. Hutchinson on plants formerly regarded as varieties of *M. frondosa*; *Randia Brandisii* (= *R. tomentosa*, Wight & Arnott, not of Blume); *Tricalysia sphaerocarpa* and *T. apiocarpa*, transferred from *Diplospora*; *Plectronia ficiformis* and *P. pergracilis* (= *Canthium ficiforme*, Hook. f., and *C. pergracile*, Bourd.); *Pavetta zeylanica* (= *P. hispidula*, var. *zeylanica*, Hook. f.); *Stylocoryne lucens*, *S. canarica*, and *S. nilagirica*, transferred from *Webera*; *Anaphalis subdecurrens* (= *Gnaphalium subdecurrens*, DC.), and *A. Lawii* (= *A. oblonga*, DC., var. *Lawii*, Hook. f.); *Campanula Wightii* (= *C. ramulosa*, Wight, not of Wallich); and *Isonandra montana*, based on *I. Wightiana*, A. DC., var. *montana*, Thwaites.

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* Flora of the Presidency of Madras, by J. S. Gamble. Part IV. Published under the authority of the Secretary of State for India in Council. London: Adlard & Son & West Newman, Ltd., 1921. pp. 579–768. Price 10*s*. or 6 rupees 8 a. net.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 9] [1921

XLI. ALPHABETICAL LIST OF NOMINA CONSERVANDA

(Phanerogamae).

T. A. Sprague.

During the course of investigations preparatory to the International Botanical Congress of Vienna (1905) it was found that the strict application of the principle of priority of publication to genera would entail the replacement of several hundred well-known generic names by little known ones. It was felt that the practical disadvantages of such a course were so great that it was desirable to adopt some means of preserving the names in question, and a list of Nomina Conservanda was accordingly drawn up. This consisted of generic names which should be retained in any case, the operation of the Rules of Nomenclature being suspended in so far as they required the rejection of any name included in the list.

A summary of the discussion which took place on this question at the Vienna Congress may be found in Actes Congr. Bot. Vienne, 1905, pp. 98–101. The Article providing for a list of nomina conservanda was passed by 133 votes against 36, a majority of four to one.*

A first list of Nomina Conservanda was appended to the International Rules adopted by the Vienna Congress.† This included 405 generic names of *Phanerogamae*. A second list was added in 1910.‡ This included 15 genera of *Chlorophyceae*, 17 *Phaeophyceae*, 23 *Rhodophyceae*, 1 Pteridophyte (*Selaginella*), and 53 additional *Phanerogamae*.

The phanerogamic genera were arranged in accordance with Dalle Torre et Harms, Genera Siphonogamarum, and were combined in one list in the second edition of the International Rules.§

* Actes. Congr. Bot. Vienne, 101 (1906).
† l.c. 234.
‡ *Vide* Actes. Congr. Bot. Brux., i. pp. 108–116 (1912).
§ Briquet, Règles Internat. Nomencl. Bot., ed. 2. p. 78 (1912).

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It has been found in practice that a systematic method of arrangement of nomina conservanda is not very convenient for consultation, and that it has led to certain nomina conservanda being overlooked. Furthermore, the works in which these lists appeared are inaccessible to a large number of botanists. It accordingly seems desirable to publish a list of the Nomina Conservanda (*Phanerogamae*) in alphabetical order. It has not been thought necessary to include references: these may be found in the Index Kewensis, the Genera Siphonogamarum and the original lists.

In agreement with the typography used in the second edition of the International Rules the names of certain early authorities who did not adopt the binary system of nomenclature are cited in square brackets, *e.g. Canella* [P. Br.] Sw. (1791).

Acronychia, Forst. (1776).
Actinomeris, Nutt. (1818).
Adenandra, Willd. (1809).
Adesmia, DC. (1825).
Adlumia, Rafin. (1808).
Aechmea, Ruiz et Pav. (1794).
Aegle, Correa (1800).
Aerva, Forsk. (1775).
Agapanthus, L'Hérit. (1788).
Agathis, Salisb. (1807).
Agathosma, Willd. (1809).
Agonis, Lindl. (1839).
Ailanthus, Desf. (1789).
Alangium, Lam. (1783).
Allionia, L. (1759); emend. Choisy (1849).
Alloplectus, Mart. (1829).
Alysicarpus, Neck. (1790).
Alyxia, Banks ex R. Br. (1810).
Amaracus, Gleditsch. (1764).
Amasonia, L.f. (1781).
Amberboa, Less. (1832).
Amianthium, A. Gray (1837).
Amorphophallus, Blume ex Decne. (1835).
Amphicarpaea, Ell. (1818).
Amphirrhox, Spreng. (1827).
Amsinckia, Lehm. (1831).
Anarrhinum, Desf. (1800).
Ancistrocladus, Wall. (1829).
Andira, Lam. (1783).
Anisotes, Nees (1847).
Antiaris, Lesch. (1810).
Aquilaria, Lam. (1786).
Arceuthobium, Bieb. (1819).
Ardisia, Sw. (1788).
Arenga, Labill. (1803).
Argania, Roem. et Schult. (1819).
Argyrolobium, Eckl. et Zeyh. (1836).
Artanema, D. Don (1835).
Ascolepis, Nees ex Steud. (1855).
Aspidosperma, Mart. et Zucc. (1824).
Astelia, Banks et Sol. ex R. Br. (1810).
Atlantia, Correa (1805).
Athenaea, Sendtn. (1846).
Bacopa, Aubl. (1775).
Balanites, Delile (1813).
Barosma, Willd. (1809).
Barringtonia, Forst. (1776).
Belamcanda, Adans. (1763).
Belmontia, E. Mey. (1837).
Berkheya, Ehrh. (1788).
Berrya, Roxb. (1814).
Biarum, Schott (1832).
Bifora, Hoffm. (1816).
Bikkia, Reinw. (1826).
Blumea, DC. (1833).
Bobartia, Salisb. (1812).
Borreria, G. F. W. Mey. (1818).
Bouchea, Cham. (1832).
Brickellia, Ell. (1824).
Brodiaea, Smith (1811).
Brosimum, Sw. (1788).
Brownea, Jacq. (1760).
Brucea, J. F. Mill. (1780).
Buchloë, Engelm. (1859).
Buckleya, Torr. (1843).
Bulbine, Willd. (1809).
Bulbophyllum, Thou. (1822).
Bumelia, Sw. (1788).
Bursera, Jacq. ex L. (1762).
Butea, Koenig ex Roxb. (1795).
Cajanus, DC. (1813).
Calandrinia, H. B. K. (1823).
Calanthe, R. Br. (1821).
Calliandra, Benth. (1840).
Callistephus, Cass. (1825).
Calodendrum, Thunb. (1782).
Calopogon, R. Br. (1813).
Calycanthus, L. (1759).
Calyptranthes, Sw. (1788).
Calystegia, R. Br. (1810).
Camassia, Lindl. (1832).

Canavalia, DC. (1825).
Canella, [P. Br.] Sw. (1791).
Cansjera, Juss. (1789).
Capsella, Medik. (1792).
Carallia, Roxb. ex R. Br. (1814).
Careya, Roxb. (1814).
Carissa, L. (1767).
Carya, Nutt. (1818).
Cavendishia, Lindl. (1836).
Cayaponia, Silva Manso (1836 vel 1837 ?).
Caylusea, A St.-Hil. (1837).
Cecropia, L. (1758).
Centrosema, Benth. (1838).
Cephaëlis, Sw. (1788).
Chaenostoma, Benth. (1835).
Chamaedorea, Willd. (1806).
Chamissoa, H. B. K. (1817).
Chaptalia, Vent. (1800).
Chlorogalum, Kunth (1843).
Chonemorpha, G. Don (1838).
Chrozophora, Neck. (1790).
Chrysopsis, Ell. (1824).
Clianthus, Banks et Sol. ex G. Don (1832).
Cnicus, Gaertn. (1791).
Coccocypselum, Schreb. (1791).
Cocculus, DC. (1818).
Cochlospermum, Kunth. (1822).
Codiaeum, Adr. Juss. (1824).
Cola, Schott et Endl. (1832).
Colea, Boj. (1837).
Coleanthus, Seidl. (1817).
Colubrina, Rich. ex Brongn. (1827).
Commiphora, Jacq. (1797).
Copaifera, L. (1762).
Cordylanthus, Nutt. ex Benth. (1846).
Cordyline, Comm. ex Juss. (1789).
Corydalis, Medik. (1789).
Corynephorus, Beauv. (1812).
Crudia, Schreb. (1789).
Crypsis, Ait. (1789).
Cryptotaenia, DC. (1829).
Ctenium, Panz. (1814).
Cunninghamia, R. Br. (1826).
Cyanotis, D. Don (1825).
Cybianthus, Mart. (1829).
Cymodocea, C. Koenig (1805).
Cynodon, Rich. (1805).
Cytinus, L. (1764).

Daboecia, D. Don (1834).
Dalbergia, L.f. (1781).
Dendrobium, Sw. (1799).
Derris, Lour. (1790).
Descurainia, Webb et Berth. (1836–50).
Desmanthus, Willd. (1806).
Desmodium, Desv. (1813).
Desmoncus, Mart. (1824).
Diarrhena, Beauv. (1812).
Dicentra, Bernh. (1833).
Dichorisandra, Mikan (1820).
Dicliptera, Juss. (1807).
Dictyoloma, Adr. Juss. (1825).
Didymocarpus, Wall. (1819).
Dipteryx, Schreb. (1791).
Disparago, Gaertn. (1791).
Dissotis, Benth. (1849).
Dombeya, Cav. (1786).
Downingia, Torr. (1856).
Dryandra, R. Br. (1810).
Duguetia, A. St.-Hil. (1825).
Duroia, L.f. (1781).

Ecballium, A. Rich. (1824).
Echinaria, Desf. (1798–1800).
Echinocystis, Torr. et Gray (1840).
Eclipta, L. (1771).
Ehrharta, Thunb. (1779).
Eichhornia, Kunth (1843).
Eleutherine, Herb. (1843).
Ellisia, L. (1763).
Elytraria, Rich. (1803).
Embelia, Burm. f. (1768).
Emex, Neck. (1790).
Enicostemma, Blume (1826).
Entada, Adans. (1763).
Epiphegus, Nutt. (Maio 1818).
Eranthis, Salisb. (1807).
Eria, Lindl. (Aug. 1825).
Erophila, DC. (1821).
Euclidium, R. Br. (1812).
Eucomis, L'Hérit. (1788).
Eulophia, R. Br. (1823).
Eusideroxylon, Teysm. et Binn. (1863).
Exocarpum, Labill. (1798).
Eysenhardtia, H. B. K. (1824).

Fagopyrum, Moench (1794).
Falcaria, Host (1827).
Fedia, Moench (1794).
Felicia, Cass. (1818).
Ficinia, Schrad. (1832).
Fimbristylis, Vahl (1806).
Franseria, Cav. (1793).

Galactites, Moench. (1794).
Gaylussacia, H. B. K. (1819).
Gazania, Gaertn. (1791).
Gerbera, Cass. (1817).
Glossostigma, Wight et Arn. (1836).
Glyceria, R. Br. (1810).
Gordonia, Ellis (1770).
Guatteria, Ruiz et Pav. (1794).
Guizotia, Cass. (1827).
Gustavia, L. (1775).
Gynandropsis, DC. (1824).
Gynura, Cass. (1825).

Halenia, Borkh (1796).
Haplopappus, Cass. (1828).
Haworthia, Duval (1809).
Hebecladus, Miers (1845).
Heberdenia, Banks ex A.DC. (1841).
Helicodiceros, Schott (1853).
Heliconia, L. (1771).
Helinus, E. Mey. ex Endl. (1840).
Helosis, Rich. (1822).
Hesperochiron, S. Wats. (1871).
Heteranthera, Ruiz et Pav. (1794).
Heterolepis, Cass. (1820).
Hierochloë, R. Br. (1810).
Holigarna, Buch.-Ham. ex Roxb. (1814).
Holodiscus, Maxim. (1879).
Hosta, Tratt. (1812).
Humboldtia, Vahl (1794).
Hybanthus, Jacq. (1760).
Hydrolea, L. (1763).
Hymenocarpos, Savi (1798).
Hypodiscus, Nees (1836).
Hypolaena, R. Br. (1810).
Hyptis, Jacq. (1786).

Ichnocarpus, R. Br. (1809).
Iochroma, Benth. (1845).
Iresine, [P.Br.] L. (1759).
Isopogon, R. Br. ex Knight (1809).

Jacobinia, Moric. (1846).
Jambosa, DC. (1828).
Julocroton, Mart. (1837).

Kennedya, Vent. (1804).
Knightia, R. Br. (1810).
Krigia, Schreb. (1791).
Kundmannia, Scop. (1777).

Lachnanthes, Ell. (1816).
Laetia, Loefl. (1758).
Lagascea, Cav. (1803).
Lamarckia, Moench. (1794).
Landolphia, Beauv. (1806).
Lannea, A. Rich. (1832).
Laportea, Gaudich. (1826).
Laurelia, Juss. (1809).
Lebetanthus, Endl. (1841).
Leersia, Sw. (1788).
Leucadendron, Berg. emend. R. Br. (1810).
Leucospermum, R. Br. (1810).
Liatris, Schreb. (1791).
Libertia, Spreng. (1825).
Limnophila, R. Br. (1810).
Linociera, Sw. (1791).
Liparis, Rich. (1818).
Lipocarpha, R. Br. (1818).
Listera, R. Br. (1813).
Litsea, Lam. (1789).
Lobularia, Desv. (1814).
Logania, R. Br. (1810).
Loiseleuria, Desv. (1840).
Lomatia, R. Br. (1810).
Lonchocarpus, H. B. K. (1824).
Lonchostoma, Wikstr. (1818).
Lucya, DC. (1830).
Luzula, DC. (1805).
Luzuriaga, Ruiz et Pav. (1802).
Lyginia, R. Br. (1810).

Maclura, Nutt. (1818).
Macrolobium, Schreb. (1789).
Mahonia, Nutt. (1818).
Maianthemum, Web. (1780).
Majorana, Boehm. (1760).
Malcolmia, R. Br. (1812).
Malvastrum, A. Gray (1849).
Mamillaria, Haw. (1812).
Manettia, Mutis ex L. (1771).
Manulea, L. (1767).
Melaleuca, L. (1767).
Mertensia, Roth (1797).
Metrosideros, Banks ex Gaertn. (1788).
Miconia, Ruiz et Pav. (1794).
Micranthemum, Rich. (1803).
Mikania, Willd. (1803-4).
Mitragyna, Korth. (1839).
Monochaetum, Naud. (1845).
Mucuna, Adans. (1763).
Muellera, L.f. (1781).
Murraya, Koenig ex L. (1771).
Myristica, Rottb. (1778).
Myroxylon, L.f. (1781).

Naregamia, Wight et Arn. (1834).
Narthecium, Juss. (1789).
Nasturtium, R. Br. (1812).
Nemopanthus, Rafin. (1819).
Neottia, Sw. (1800).
Nerine, Herb. (1820).
Nertera, Banks et Sol. ex Gaertn. (1788).
Nervilia, Comm. ex Gaudich. (1826).
Nicandra, Adans. (1763).
Nothopegia, Blume (1850).
Nothoscordum, Kunth (1843).

Oberonia, Lindl. (1830).
Oeonia, Lindl. (1824).
Oligomeris, Cambess. (1841–44).
Omphalea, L. (1759).
Ormocarpum, Beauv. (1804).
Ormosia, Jack (1811).
Orphium, E. Mey. (1837).
Ouratea, Aubl. (1775).
Oxylobium, Andrews (1809).
Oxypetalum, R. Br. (1809).
Oxytropis, DC. (1802).

Pachyrrhizus, Rich. ex DC. (1825).
Paederia, L. (1767).
Paepalanthus, Mart. (1835).
Pallenis, Cass. (1822).
Parthenocissus, Planch. (1887).
Patersonia, R. Br. (1810).
Patrinia, Juss. (1807).
Pavonia, Cav. (1786).
Peltophorum, Walp. (1842).
Persea, Gaertn. f. (1805)
Persoonia, Sm. (1798).
Petalostemon, Michx. (1803).
Phaulopsis, Willd. (1800).
Philodendron, Schott (1829).
Phrynium, Willd. (1797).
Phyllocladus, Rich. (1826).
Physocarpus, Maxim. (1879).
Picrammia, Sw. (1788).
Pilea, Lindl. (1821).
Pimelea, Banks et Sol. ex Gaertn. (1788).
Piscidia, L. (1759).
Pitcairnia, L'Hérit. (1789).
Pithecolobium, Mart. (1837).
Platanthera, Rich. (1818).
Platylepis, A. Rich. (1828).
Plectranthus, L'Hérit. (1785).
Podalyria, Lam. (1793).
Podocarpus, L'Hérit. ex Pers. (1807).
Podolepis, Labill. (1806).
Polycarpaea, Lam. (1792).
Polypompholyx, Lehm. (1844).
Polystachya, Hook. (1825).
Pongamia, Vent. (1803).
Printzia, Cass. (1825).
Protea, R. Br. (1810).
Protium, Burm. f. (1768).
Psophocarpus, Neck. (1790).
Psychotria, L. (1759).
Pterolobium, R. Br. (1814).
Pteronia, L. (1763).
Pterospermum, Schreb. (1791).
Pterostylis, R. Br. (1810).
Pupalia, Juss. (1803).
Pycnanthemum, Rich. (1803).
Pyrenacantha, Wight (1831).
Pyrrhopappus, DC. (1838).

Saccolabium, Blume (1825).
Samadera, Gaertn. (1791).
Sansevieria, Thunb. (1794).
Scaevola, L. (1771).
Schaueria, Nees (1838).
Schleichera, Willd. (1805).
Schoenolirion, Durand (1855).
Schoenoplectus, Palla (1888).
Schotia, Jacq. (1786).
Schradera, Vahl (1796).
Scleropyrum, Arn. (1838).
Scolopia, Schreb. (1789).
Scutia, Comm. ex Brongn. (1827).
Sechium, [P. Br.] Juss. (1789).
Securigera, DC. (1805).
Securinega, Comm. ex Juss. (1789).
Sequoia, Endl. (1847).
Sesbania, Scop. (1777).
Seymeria, Pursh. (1814).
Shepherdia, Nutt. (1818).
Silybum, Adans. (1763).
Simethis, Kunth (1843).
Siphonychia, Torr. et Gray (1838).
Skimmia, Thunb. (1783).
Smilacina, Desf. (1807).
Smithia, Ait. (1789).
Sonerila, Roxb. (1814).
Sonneratia, L.f. (1781).
Sorbaria, A. Br. (1864).
Sorocephalus, R. Br. (1810).
Spathelia, L. (1763).
Spergularia, J. et C. Presl (1819).
Sphacele, Benth. (1829).
Sphenoclea, Gaertn. (1788).
Spiranthes, Rich. (1818).
Stachytarpheta, Vahl (1805).
Stelis, Sw. (1799).
Stemodia, L. (1759).
Stenocarpus, R. Br. (1810).
Stephanomeria, Nutt. (1841).
Steriphoma, Spreng. (1827).
Stifftia, Mikan (1820).
Struthiola, L. (1767).
Suaeda, Forsk. (1775).
Suksdorfia, A. Gray (1880).
Swartzia, Schreb. (1791).
Symplocarpus, Salisb. ex Nutt. (1818).

Rehmannia, Libosch. ex Fisch. et Mey. (1835).
Reineckea, Kunth (1844).
Rhaphiolepis, Lindl. (1820).
Rhipsalis, Gaertn. (1788).
Rhodothamnus, Reichb. (1827).
Rhynchocorys, Griseb. (1844).
Rhynchosia, Lour. (1790).
Rhynchospora, Vahl (1806).
Romulea, Maratti (1772).
Rottboellia, L.f. (1779).
Ryania, Vahl (1796).

Tacca, Forst. (1776).
Tapeinochilus, Miq. (1868).
Taraxacum, Wiggers (1780).
Tectona, L.f. (1781).
Telopea, R. Br. (1810).
Tephrosia, Pers. (1807).
Terminalia, L. (1767).
Ternstroemia, Mutis ex L.f. (1781).
Tetragonolobus, Scop. (1772).
Thevetia, Adans. (1763).
Thymelaea, Endl. (1847).
Thysanotus, R. Br. (1810).

Timonius, DC. (1830).
Tinantia, Scheidw. (1839).
Toddalia, Juss. (2 sem. 1789).
Tolmiea, Torr. et Gray (1840).
Tourrettia, Fougeroux (1787).
Tragus, [Hall] Scop. (1777).
Trichilia, [P. Br.] L. (1759).
Trichodesme, R. Br. (1810).
Tricyrtis, Wall. (1826).
Trigoniastrum, Miq. (1860).
Trinia, Hoffm. (1814).
Trophis, [P. Br.] L. (1759).

Uncaria, Schreb. (1789).
Urceolina, Reichb. (1828).
Ursinia, Gaertn. (1791).

Ventenata, Koel. (1802).
Vernonia, Schreb. (1791).
Verticordia, DC. (1826).
Villarsia, Vent. (1803).
Vismia, Vand. (1788).
Vochysia, Juss. (1789).
Vriesea, Lindl. (1843).

Wahlenbergia Shcrad. (1814).
Wallenia, Sw. (1788).
Watsonia, Mill. (1759).
Weihea, Spreng. (1825).
Weinmannia, L. (1759).
Welwitschia, Hook. f. (1862).
Wikstroemia, Endl. (1833).
Wistaria, Nutt. (1818).
Withania, Pauquy (1824).

Xanthophyllum, Roxb. (1814).
Xylopia, L. (1759).
Xylosma, Forst. f. (1786).

Zamia, L. (1763).
Zantedeschia, Spreng. (1826).
Zelkova, Spach (1841).
Zeugites, [P. Br.] Schreb. (1791).
Zinnia, L. (1759).
Zoisia, Willd. (1801).

XLII.—THE PHYTOPATHOLOGICAL SERVICE IN THE NETHERLANDS AND ITS COLONIES.

J. C. Th. Uphof.

During the last decade the Phytopathological Service of the Netherlands has developed extensively throughout the country, and its activities are very numerous. Though it belongs to a small nation, it is the outcome of much painstaking work, and will not be found in such a high degree of development in any other country.

Dutch scientists have long been engaged in investigations on plant diseases or pests, for instance Dr. Snellen van Vollenhoven (1843), and Dr. J. Wttwaal (1860); later came the very active and eminent plant pathologist, Prof. Dr. J. Ritzema Bos, who from 1869 to 1920 has been the chief leader in Holland from the standpoint of original research, plant disease control, lecturing and popularising the knowledge of plant pathology among the masses of agricultural and horticultural people.

In 1895 the Phytopathological Laboratory "Willie Commelin Scholten" in Amsterdam was established out of private funds, Ritzema Bos being appointed Director, as well as Professor of Plant Pathology at the University of Amsterdam. In his inaugural speech at the University, he pointed out that phytopathology should not be considered as a part of botany, but as an independent science.

The main object of the institution was to study plant diseases and give advice and demonstrations to growers. The results of

the investigations were published in the Tijdschrift over Plantenziekten (Journal for Plant Diseases), and other periodicals, and as Memoirs. The general interest taken in it is shown from the correspondence. In 1895, the first year, 376, in 1905, 1272, in 1911, about 4900, and in 1912, 6804 letters were sent out.

In 1891 Prof. Dr. Hugo de Vries, Prof. Dr. Ritzema Bos, Dr. H. W. Heinsius and Dr. H. T. Calkoen organised the Netherlands Phytopathological Society, and the above-mentioned Tijdschrift voor Plantenziekten became its leading paper.

In 1899 the actual Phytopathological Service was established, more particularly in consequence of some restrictions made by the United States of America as to San José Scale, peach yellows and rosette. These diseases were unknown in the Netherlands, but certificates were required from nurserymen that their exported stock was free from these diseases or pests and "any other dangerous insects or plant diseases that might be transferred on nursery stock to other nurseries or to the orchard." At that time only nurseries were inspected, and not the actual exported plants.

From 1899 until 1906 the Phytopathological Service was situated in Amsterdam. From 1906 until the present time the seat has been at Wageningen. Prof. J. Ritzema Bos remained Director, whereas Dr. Johanna Westerdijk, who is also Professor of Plant Pathology at the University of Utrecht, took charge of the institution "Willie Commelin Scholten" in Amsterdam as well. Quite recently the institution "Willie Commelin Scholten" was removed to Baarn.

An important advance was made in 1909, when the Phytopathological Service was divided into a general and a special branch. The former took charge of questions of control of plant diseases and pests, and stands in close connection with the Government Institution for Plant Pathology of the Agricultural College at Wageningen. The latter service took charge of nursery inspection and kindred activities.

At the present time the entire Phytopathological Service is independent of the Institution for Plant Pathology.

The present Phytopathological Service is extensive and employs a large staff of scientifically and technically trained men, as well as several persons employed in offices, museums, laboratories and experimental fields.

The Director of the Service is assisted by three phytopathologists, one ornithologist, two agricultural and horticultural experts, besides twenty-two technical officials and controllers; the latter residing in various parts of the Netherlands, especially in agricultural and horticultural centres such as Boskoop, Aalsmeer, Naarden, Oudenbosch, Naaldwijk, Lisse, Hoorn, Venlo, Elst and other places. A technical curator is employed in the museum.

In the administrative section seven persons are employed, while six take charge of laboratories and experimental fields.

Further, there are about 200 correspondents and collaborators distributed over the entire country; these men are usually educated in agricultural and horticultural schools or colleges, and have therefore a fundamental knowledge of plant diseases, pests, and their control.

The Phytopathological Service is divided into six chief sections, which are able to work more or less independently of each other.

i. *Section for examination of diseases and infected plants.* Information is given to agriculturists, horticulturists, foresters and amateurs who require advice as to the life-history of disease-causing fungi or animals and as to the methods for combating them. If necessary, inspections are made free of cost. The laboratories of this section are well equipped with modern apparatus for making pure cultures of fungi and raising various pests. Experimental fields and greenhouses have also been erected in order to carry out inoculation experiments. The investigations are carried on in a general manner; they are not conducted extensively nor purely scientifically, though enough is being done to provide for correct diagnoses of diseases and to recommend suitable remedies.

This division also sends, when necessary, contributions on diseases to various periodicals and newspapers. It issues warnings at various times when certain diseases may become prevalent. It distributes pamphlets, which treat in a popular way of diseases and pests of special interest and kindred subjects.

ii. The second section takes charge of methods of combating diseases and pests of horticultural crops, and forms a very important branch of the Phytopathological Service. Such a branch is especially necessary in a country like Holland, where horticulture is mainly developed in centres; where sometimes several hundred growers are near each other, such as Boskoop, Aalsmeer, Naaldwijk, and other places, where the growers have one common interest in their work. In such localities it is necessary to use every efficient method to combat disease. Further, inquiries are made as to the distribution and virulence of certain diseases. Lectures and field demonstrations are given whenever necessary, and short notices are sent to local newspapers. Personal visits are paid to nurserymen and other growers, where special advice is given as to problems of plant pathology or methods of combating diseases are demonstrated. The staff receives much co-operation from its many collaborators in this line of work. Publications of a somewhat technical nature for the horticulturist are abstracted and utilised as propaganda.

iii. The third section is interested in combating diseases and pests from an agricultural standpoint, and works upon the same principles as the former. It covers a much larger area, because at the present time agriculture is not as intensively centralised as horticulture. In this respect also collaborators are of great help, and are well acquainted with most diseases and pests of

farm crops. Lectures and demonstrations are usually given in winter, while in summer field demonstrations and excursions are held whenever they are wanted. Collaborators who render services do not receive any salary, though travelling and hotel expenses are refunded by the Government. Fields are carefully inspected and the question of selling seeds or using them as planting material decided. Great care is exercised in the inspection of potatoes. Much advantage is taken of technical publications dealing with agricultural crops.

iv. Another branch of work of much importance is the supervision of the laws relating to disease, which includes also the control of plants for export. In the former case measures have been prescribed against the wart disease of potatoes and American gooseberry mildew. The areas of land are carefully inspected and, in fields where wart disease is found, all plants are destroyed by boiling. The growing of potatoes in infested fields is prohibited, the growers receiving indemnification for any loss caused by this enforcement of the law.

As regards American gooseberry mildew the tops of the twigs of the current year are cut off and burnt, while the soil round the shrub is dug up for a few inches. The transport of gooseberries from infested orchards is also controlled.

The Phytopathological Service of the Netherlands was the first in any country to insist on the inspection of plants, or parts of plants, destined for export, in order to guarantee the absence of diseases or pests. Before packing, all plants are inspected by controllers, and a certificate is given for export in cases of freedom from disease. No permission is accorded to export infected goods, which is of considerable importance in preserving the reputation of Dutch growers abroad. This control on export existed in the Netherlands long before freedom from disease was required by any country as a necessary condition of import. Later on, rigid restrictions on the import of live plants, bulbs and potatoes were enforced by various Governments, *e.g.*, the United States of America, New Zealand, South Africa, and Czecho-Slovakia. The propaganda which had long been actively carried on in Holland had already greatly contributed to the improvement in the health of plants, so that the task of the Governments in the enforcement of legislation was much facilitated.

v. The ornithological section, which is also of importance, studies the bird species which are useful or harmful to crops, their habits and time of breeding being observed all over the country.

vi. A very important section is that which takes charge of the sections of horticultural and agricultural shows relating to diseases and pests. In every part of Hollard where such exhibitions take place, there are very neat-looking stands from the Phytopathological Service showing various stages in the development of diseases, preserved either in alcohol, formalin, as mounted

herbarium species, and the like. Further, there are statistical tables, descriptions of the life-history of fungi and insects and microscopical slides. Not only in the Netherlands, but also abroad, this division is very active. For example, the author noticed at the Lille Exhibition, in the department of Dutch exhibitors, a large stand on plant diseases which was sent by the Phytopathological Service of Wageningen.

Much work is done in organising Phytopathological Research in the Dutch possessions, especially the Dutch East Indies, though a Phytopathological Service such as exists in Holland has not yet been established.

The Department of Agriculture has in Java a Laboratory for Plant Diseases where a staff of botanists and zoologists are already engaged upon various lines of research, while several private companies have also engaged botanists or trained phytopathologists to study various pests and diseases and to find means of eradicating them; such stations have been established in Malang and Deli, and the Java Sugar industry possesses one.

No doubt in the near future the Dutch East and West Indies will also have a very extensive Phytopathological Service, as well organised as other institutes for tropical agriculture already formed.

XLIII.—THE YELLOW PINES OF NORTH AMERICA.

W. Dallimore.

In Canada and the United States there are several groups of species of *Pinus* that bear similar common names, one of the most important being designated "yellow pine." The yellow pines include species that are very different in general appearance and in working qualities, whilst they are as widely separated geographically as it is possible for them to be. From these facts it is desirable that persons handling the timber should have an intimate knowledge of the several species, and of their distribution.

The yellow pines include the following species :—

P. cubensis, Grisebach.
P. mitis, Michaux.
P. monticola, Douglas.
P. palustris, Miller.
P. ponderosa, Douglas.
P. Strobus, Linnaeus.
P. Taeda, Linnaeus.
P. virginiana, Miller.

As all are known by several common names in addition to that of yellow pine, the various synonyms are given with each species.

P. cubensis, *Grisebach.*—Bastard Pine, Cuban Pine, Meadow Pine, Pitch Pine, She Pine, She Pitch Pine, Slash Pine, Spruce Pine, Swamp Pine, Yellow Pine.

This is the most tropical of the Eastern N. American species. Its northern limit is reached in S. Carolina, and it is found in Georgia, Southern Alabama, Louisiana and Florida, extending

thence to the Bahamas, Honduras, and Guatemala. Mature trees range up to 150 ft. in height, with a diameter of 3 ft., and often a clear trunk of 50–60 ft. The leaves may be in pairs or in clusters of three. They average 9 ins. in length, are deep green in colour, and have finely-toothed margins, and short, horny points. The cones resemble those of the European *P. Pinaster* in shape and colour, and are 4–5 in. long by 2–2½ in. in width. The timber is heavy, about 39 lbs. per cubic foot, strong, rather coarse-grained, resinous and of good quality. It most closely approaches that of *P. palustris* in character, and can be used for similar purposes, in fact it is often marketed with the wood of that tree and is very similar in strength. Resin is sometimes obtained from standing trees by tapping, whilst tar, turpentine and other products are procured by destructive distillation of the wood. The resin is said to yield more turpentine than that of *P. palustris*.

P. mitis, *Michaux* (*P. echinata*, Miller).—Bull Pine, Carolina Pine, North Carolina Pine, North Carolina Yellow Pine, Oldfield Pine, Pitch Pine, Poor Pine, Short-leaf Pine, Short-leaved Yellow Pine, Shortschat Pine, Spruce Pine, Virginia Yellow Pine, Yellow Pine.

P. mitis and two other species, *P. palustris* and *P. Taeda*, are often referred to indiscriminately as yellow pine or eastern yellow pine, and their wood is often mixed when marketed, although the three trees are perfectly distinct in growth, foliage and cones. Moreover, the wood of *P. palustris* at its best is much superior to that of the better grades of lumber of the other two. Microscopically, however, the structure of the three species is so similar that it is practically impossible to separate one from the other. *P. mitis* is often distinguished as "short-leaf pine" or "short-leaved yellow pine." It is widely distributed in Eastern N. America and covers many hundreds of square miles from New York to N. Florida and from the Atlantic to Arkansas and Texas. It varies in height from 80–120 ft., and in diameter from 1½–2 ft. The young shoots are distinct by reason of their violet markings and glaucous bloom, whilst the slender, flexible, slightly-twisted leaves are 3–5 in. long, and produced in pairs or occasionally in threes. The cones are usually clustered, ovate, and 1½–2 in. long, each scale being terminated by a short prickle which is usually deciduous before the fall of the cones. *P. mitis* is an important timber tree, the wood being of good quality with orange or yellowish-brown heartwood and creamy-yellow sapwood. It is less resinous and more easily worked than that of *P. palustris*, and is employed for the lighter kinds of building construction, the indoor finish of houses, panelling, car-building, furniture, railway sleepers, and for all other purposes for which good pine wood can be utilised. As is the case with many other trees from Eastern N. America it does not thrive in the British Isles, although small specimens are sometimes seen.

P. monticola, *Douglas*.—Finger-cone Pine, Idaho White Pine, Little Sugar Pine, Mountain Pine, Mountain White Pine, Short-leaved Weymouth Pine, Silver Pine, Soft Pine, Sugar Pine, White Pine, Yellow Pine.

A tree attaining in America a height of 80–175 ft. with a trunk 15–25 ft. in girth. The young shoots are clothed with minute reddish down and by this character the species may be distinguished from its near ally *P. Strobus*, for, when down is present on the young shoots of the latter species it is confined to small patches at the base of leaf clusters. The leaves are in fives, glaucous-green, dense on the branchlets and rarely more than 4 in. long. The cones resemble those of *P. Strobus*, but are composed of a larger number of scales. There is little difference between the wood of this species and of *P. Strobus*, and both can be used for the same purposes (*see P. Strobus*). *P. monticola* is found in the Pacific Coast region, extending from the southern part of British Columbia to the western slopes of the Rocky Mountains in Northern Montana, the coast region of Washington and Oregon and the Cascades and Sierra Nevada ranges in California. In its more southern localities it attains an altitude of 10,000 ft.

P. palustris, *Miller*.—Broom Pine, Fat Pine, Florida Pine, Florida Long-leaf Pine, Florida Yellow Pine, Georgia Pine, Georgia Heart Pine, Georgia Long-leaf Pine, Georgia Pitch Pine, Heart Pine, Long-leaf Pitch Pine, Longstraw Pine, Rosemary Pine, Southern Hard Pine, Southern Heart Pine, Southern Pitch Pine, Southern Yellow Pine, Texas Long-leaf Pine, Texas Yellow Pine, Turpentine Pine, Yellow Pine.

In the British Isles this tree and its timber is usually known under the common name of Pitch Pine, but in America it is recognised as Long-leaf Pine, the term Pitch Pine being more general in connection with *P. rigida*. The species attains a height of 80–110 ft. and a girth of 9 ft., and the branches are often gnarled and twisted. The leaves are in threes, densely crowded on the branchlets, slender, flexible, up to 18 in. long on young vigorous trees and about 9 in. long on old specimens. The cones are cylindrical, 6–10 in. long and 2–3 in. wide, dull brown and usually leave a few scales attached to the branches when they fall. It forms pure forests many miles in width in the Atlantic and Gulf States from Virginia to Florida. The wood is hard, strong and resinous, and is usually regarded as the strongest and most durable of pine timbers. It is used extensively for heavy construction and all kinds of purposes where strength and durability are concerned. Large quantities of wood are used for naval architecture, school and church furniture, flooring, panelling, telegraph and telephone poles, &c. *P. palustris* is the most important resin-producing pine in N. America, and there is a considerable industry in tapping, and in the collection and distillation of the resin. There is also an industry connected with the leaves, for the fibre is

extracted and used for stuffing mattresses and pillows, and for weaving into a coarse kind of matting. The water required in the preparation of the fibre has been used afterwards for medicinal baths. By destructive distillation of the wood, pitch, tar, tar oils, and charcoal are obtained. Although introduced to the British Isles nearly 200 years ago few specimens are known to exist in this country, for it is not suited to our climate.

P. ponderosa, *Douglas.*—Big Pine, Bull Pine, Heavy Pine, Heavy-wooded Pine, Longleaf Pine, Pitch Pine, Western Yellow Pine, Yellow Pine.

In its widest sense and particularly from a commercial point of view, this species includes *P. arizonica*, Engelmann and *P. Jeffreyi*, Greville, for although often regarded as distinct species, the distinctions are geographical rather than botanical, and the timber is indistinguishable. *P. ponderosa* is a very variable species, ranging in its native localities from 60–230 ft. in height with a straight clean trunk up to 25 ft. in girth. The branches are usually stout, spreading, and often drooping. the leaves are in threes, lasting three years, densely crowded on the branchlets, rigid, curved, varying on different trees from 3–10 in. in length, the longer ones having a basal sheath nearly an inch long. The cones also vary greatly. They may be solitary or in clusters, and from 3–8 in. long and 3–4½ in. wide before opening. When they fall from the tree a few basal scales are usually left on the branches. The wood is hard, strong, resinous, close-grained and easy to work. It is obtainable in large dimensions and is used for heavy construction, the indoor finish of houses, joists, cupboards, doors, flooring, general carpentry, boxes, fencing, railway sleepers, pit props and fuel. If used in contact with the soil it must be treated with a preservative. Resin can be obtained from the trunk by the usual methods of extraction and in Oregon, fibre extracted from the leaves is used for stuffing medicated pillows, mattresses, &c. A turpentiny oil and a snuff-like powder obtained during the preparation of the fibre are used in medicine in the treatment of bronchial and catarrhal complaints.* *P. ponderosa* is very widely distributed in Western N. America from the interior of British Columbia, southwards to Mexico and eastwards to N. Nebraska, the foot hills of the Rocky Mountains of Colorado and Western Texas. *P. ponderosa* thrives in the British Isles.

P. Strobus, *Linnaeus.*—Apple Pine, New England Pine, Northern Pine, Pumpkin Pine, Quebec Pine, Sapling Pine, Soft Pine, Tonawada Pine, Weymouth Pine, White Pine, Yellow Pine.

This is the most important pine of Canada and the Northern United States, but the timber is becoming scarce. It usually attains a height of 80–150 ft. with a tapering trunk 9–12 ft. in girth. The bark is smooth and thin except at the base of old

* Diplomatic and Consular Reports, No. 2666, 1900, p. 23.

trees, where it may be 1–2 in. thick. The leaves are in fives, 3–5 in. long, slender and glaucous-green, the basal sheath falling early. The cones are cylindrical, pendulous, and borne near the points of the shoots. They are 4–6 in. long, about 1 in. in diameter and very resinous. The northern range of *P. Strobus* extends from Newfoundland to Manitoba, and it occurs throughout the Northern States from Minnesota to the Atlantic and South to Pennsylvania and to Northern Georgia. The wood is light, about 24 lbs. to the cubic foot when dry, the heartwood pinkish or light red and the sapwood pale yellow. It is straight-grained, compact, soft, easily worked, finishes well, with a fine, even surface, shrinks very little after seasoning and takes paint and polish well. In large trees the timber is singularly free from knots. It is used for general joinery, particularly the indoor finish of houses, doors, window-sashes, cupboards, joists, flooring, pattern-making for foundry work, veneered cabinets, boxes, matches, also in shipbuilding for spars and masts, and for paper pulp. The ease with which it can be worked and its freedom from serious shrinkage makes it very popular with the artisan. Timber of very good quality has been grown in the British Isles, but the species is liable to attack by several diseases, fungus and insect, hence it is not planted in quantity in this country.

Pinus Taeda, *Linnaeus*.—Bastard Pine, Black Pine, Black Slash Pine, Bull Pine, Cornstalk Pine, Foxtail Pine, Frankincense Pine, Indian Pine, Loblolly Pine, Longschap Pine, Longshucks Pine, Longstraw Pine, Meadow Pine, North Carolina Pine, Oldfield Pine, Sap Pine, Shortleaf Pine, Slash Pine, Spruce Pine, Swamp Pine, Torch Pine, Virginia Pine, Yellow Pine.

Of the many common names applied to this tree, that of Loblolly pine is the most familiar, and it is under this name that the timber should be marketed. A native of the southern and s.-eastern parts of the United States, where it is distributed from Southern New Jersey to Southern Arkansas, Oklahoma, Eastern Texas and South-western Tennessee, it forms a tree 90–110 ft. high with a girth of 6–8 ft. The leaves are in threes, lasting 3–4 years, rigid, slightly twisted, and 6–9 in. long. The cones are ovoid-oblong, 3–5 in. long, and each scale is ended by a spine. The timber is often mixed with that of other species and sold as yellow pine. It is, however, inferior to that of *P. palustris* and *P. mitis*, although quite useful for many purposes. When creosoted it is very widely used for railway sleepers. It is also useful for general carpentry, shipbuilding, box boards and many other purposes. *P. Taeda* thrives on wet ground, and is one of the first species to become established on marshy land once the soil rises above the water level. It covers very large areas, and is said to be spreading, hence it is likely to become even more important as a timber producing species, than at present. In this country it gives poor results even as a garden tree, and although introduced in 1741 no large specimens are known.

P. virginiana, *Miller.*—Bastard Pine, Cedar Pine, Jack Pine, Jersey Pine, New Jersey Pine, Nigger Pine, Oldfield Pine, Poor Pine, Poverty Pine, River Pine, Scrub Pine, Second-growth Pine, Short Pine, Short-leaved Pine, Shortschat Pine, Shortschucks, Spruce Pine, Yellow Pine.

A tree usually 30–50 ft. high with a short trunk 12–18 in. in diameter, but occasionally over 100 ft. high, with a trunk 3 ft. through. The leaves are in pairs, rigid, twisted, and 1¼–2½ in. long. The cones are solitary or in pairs, usually midway along the season's growth, oblong or conical, 1–2½ in. long and 1–1½ in. wide when expanded, and each scale is terminated by a sharp prickle. It is widely distributed in Eastern N. America from New York to Northern Alabama and from the Atlantic Coast to Southern Alabama. The wood is light, soft and brittle, the orange or brownish heartwood being greatly in excess of the yellowish sapwood. Although often knotty and only suitable for fuel and inferior work, the best timber is used for log huts, railway sleepers, fencing, &c. It is not regarded as a very good sleeper wood, however, as under heavy traffic the securing spikes are easily loosened. It is also used for paper pulp, but is said to be more suitable for the chemical than the ground wood method of manufacture. The chief value of the species centres in its ability to establish itself on heavy, clayey land where other species do not thrive and little else will grow. In the British Isles its value is purely arboricultural.

XLIV.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS,—IV.

J. Burtt-Davy.

41. Flacourtia hirtiuscula, *Oliv.*, Fl. Trop. Afr. i, 121 (1868).

South Africa. Transvaal: Waterberg Distr.; Warm Baths, Jan. and Apl. 1906, *Burtt-Davy* 5282, and in *T.D.A. Herb.* 2159, 2326; *Bolus* 13694; Marico Distr., Wonderfontein, 1100 m. alt., *Burtt-Davy* 7564.

Tropical Africa. Portuguese E. Africa: near Senna; Batoka Country, April 1860, *Dr. J. Kirk!* (*type*); between Tette and Kambassa, *Kirk!*; near Moramballa, *Kirk*; River Shire, *Kirk*; Chilabava, Lower Buzi River, 129 m., *Swynnerton* 1410. S. Rhodesia: The Matopos, *Burtt-Davy* in *Trans. Dep. Agr. Herb.* 5018; Mazoe, 1450 m., *Eyles* 533!; Bulawayo, 900 m. *Rogers* 13701!. Nyasaland: Shire Highlands, *Buchanan* 255!

Native names: Mtawa (*Buchanan*), Iqoqoyo, with a Zulu click (*Swynnerton*).

The fruit is edible; Dr. Kirk noted on his labels "dark when ripe, eatable," and again "well-flavoured, eaten"; Buchanan notes that it is a "nice fruit."

This species is a shrub or small tree of the Upper Bush-veld in the practically frostless, summer-rainfall region with a low precipitation. It is worth experimental cultivation, with a view to the possible improvement of the fruit, in S. Africa and in Florida and Southern California.

An interesting addition to the South African flora.

42. Kiggelaria africana, *L.*, Sp. Pl. p. 1037 (1753); Harv., Fl. Cap. i, 71; *K. Dregeana*, Turcz. in Bull. Soc. Nat. Mosc. 27, ii, 333 (1854)!; *K. Dregeana*, var. *acuta*, Harv., Fl. Cap. i. 71!

South Africa. Cape Province: Cape Peninsula, and Divisions of George, Uitenhage (Zuurebergen *Drège* a, type of *K. Dregeana*, Turcz.), Umtata, Somerset East and Queenstown: Basutoland: Leribe, *Dieterlen* 180!. Natal: near Enon, 900 m., *Wood* 1854!; Alexandra Distr., Dumisa, *Rudatis* 390!; without precise locality, *Gerrard* 1142!; Inanda, *Wood* 1147!. Orange Free State: Harrismith, shrub 4 ft., *Sankey* 244!. Transvaal: Pretoria, Groenkloof, *Burtt-Davy* 18,805!, 18,806!, Zoutpansberg Distr., forest at Hangklip, circiter 1800 m. alt., *Legat* 76! Lydenburg Distr.: Sabie-hoek forest, common along streams 1200–1250 m., *Burtt-Davy* 1522!, Burghers Pass up to 1500 m., *Burtt-Davy* 1557! Pilgrims Rest, 1650–1750 m., *Burtt-Davy* 1432!; Pietersburg Distr., Houtboschberg, one of the most abundant trees in the lower forest (1300–1500 m. alt.) called "um-Pata" and "Spekhout"; probably gives its name to the forest known as the Pata(ta)bosch, near Haenertsburg.

Linnaeus gives "Æthiopia" as the habitat of this species, but cites the figure in Hort. Cliff. (t. 29) which, although inaccurate in some particulars, as noted by him, definitely associates the name with the South African tree. Thunberg includes the species in the Prodromus Plantarum Capensium, Part I, p. 81, 1794, and in the Flora Capensis (ed. Schultes, 1823) p. 395, and adds: "crescit prope Cap in fossa inter Taffelberg et Leuwekopp et juxta hortos, alibique vulgaris arbor."

Timber pinkish grey, fairly close-grained, compact, neither a hard wood nor a soft wood; useful for boards, and used more or less for cabinet work and furniture, and fit for more general use. Continued immersion imparts a pink colour to the water, and the wood may have a dye value (*Dr. Sim*).

var. **obtusa,** *Burtt-Davy*, n. comb.; *K. Dregeana*, var. *obtusa*, Harv.; *K. integrifolia*, E. & Z., non Jacq.

"Tree 8–10 ft." Leaves elliptic-oblong, very obtuse (rarely some acute on the same branch) quite entire, minutely grey- or ferruginously-velutinous beneath.

South Africa. Cape Province: George, Uitenhage, Kaffraria, *E. & Z.*, p. 15, No. 117! (types); Uitenhage, *Zeyher* s.n.!; Kaffraria, *Cooper* 281!; 282!; Grahamstown, *MacOwan* s.n.!; Kariega Riv., *MacOwan* 634!; Somerset East Div., Boschberg 900 m., *MacOwan* 634!; bis; Cape Peninsula, Kloof over Roodebloem, *Wolley Dod* 2666! (pro parte). O. F. S. and Basutoland, *Cooper* 939!. Transvaal: Heidelberg Distr., between

Waterval Riv. & Zuikerbosch, 1500 m. alt., *Schlechter* 3486 ! Witwatersrand, kopjes at Johannesburg, *Burtt-Davy* 7501 ?. Records for Ermelo, Standerton and Heidelberg probably belong here.

K. Dregeana, Turcz. is based on Drège's 6722 from the Zuurebergen, Uitenhage Div. and is described as " a *K. ferruginea*, E. & Z. quae plerumque foliis integerrimis etiam gaudet, distinguitur foliis basi alternatis, nec obtusis, pubescentia tenuissima albida nec rufa, glandulis a medio liberis, nec petalis ex toto adnatis." The character of the leaf-margin (serrate or entire) is unstable, both forms being found, not infrequently, on the same branchlet.

43. Kiggelaria ferruginea, *E. & Z.*, Enum. p. 15, 1835 !

Described as a shrub, 6–15 ft. high, and conspicuous by its dense rusty tomentum on both surfaces. Dr. Sim unites this with *K. africana*, L., but though forms of the latter sometimes show a rusty tomentum there are differences in the flowers which may give tangible differentiating characters on further study. I entirely agree with Sim, however, in uniting typical *K. Dregeana*, Turcz. with *K. africana*, L.

Ecklon & Zeyher attribute only 2 styles to this plant, but Harvey thought he detected the scars of five on old capsules; Pearson's 6367 from the Khamiesberg (one of the type localities), which is obviously the same form, shows five styles, as does Drège's specimen *d* from the Paarlberg, Paarl Div., which he labelled *K. africana*, L., perhaps on that account, though it matches the Namaqualand plant.

South Africa. Namaqualand : " Kamiesberge ", *Zeyher* ! in herb. Kew (*part of type*), *Pearson* 6367 !; Orange River, *E. & Z.* 118, in herb. Kew (*part of type*) !, *Pearson & Pillans* 5867 ! 5911 ! Cape Prov. : Paarl Div., Paarlberg, *Drège* (*pro parte*); Beaufort West Div., Nieuweveldsbergen bei Beaufort, 900–1500 m. *Drège* e.

44. Pittosporum viridiflorum, *Sims*, Bot. Mag. 41, t. 1684 (1814); *P. Kruegeri*, Engl. in Notizbl. Bot. Gart. Berlin ii. 26.

A somewhat polymorphic species; the plant described as *P. Kruegeri*, Engl. has smaller flowers and shorter, rounder calyx-lobes than the typical form, but a study of the abundant material at Kew shows that intermediate forms occur and that the lobing of the calyx varies in flowers of the same inflorescence. There seems no valid reason therefore, for maintaining *P. Kruegeri*.

South Africa. Transvaal : Pretoria, colles supra Aapjes River, *Rehmann* 6513 !, Groenkloof *Burtt-Davy* 18807; Lydenburg Distr., Kluft bei Steph. Schoeman's Farm, *Wilms* 213 (type of *P. Kruegeri*, Engl.), Pilgrims Rest, *Burtt-Davy* 1415; Zoutpansberg Distr., sides of hills bounding valley between Louis Trichard and Farm Geluk, 1000–1300 m. *Legat* 29 and 32; Barberton Distr., Barberton, *Burtt-Davy* 5622; Pietersburg Distr., Magoobas Kloof, *Burtt-Davy* 5190; Houtboschberg, *Burtt-Davy* 5559; Rustenburg Distr., Magaliesberg along streams, *Pegler* 1031.

Swaziland: Forbes Reef, *Burtt-Davy* 2746. Also in Natal, Basutoland, Transkei and the Eastern Cape, extending westwards along the mountains to the George Division.

Described from specimens communicated by Mr. Sweet, from Messrs. Malcolm and Sweet's nursery at Stockwell Common, grown from seed from the "Cape of Good Hope."

Cultivated in St. Helena and the Scilly Isles. In the N. Transvaal the natives consider the tree "good medicine."

45. Salix babylonica, *L.* Sp. Pl. 1017 (1753).

South Africa. Transvaal: a quick-growing tree, hardy and readily propagated from branch-cuttings and poles; therefore extensively planted round springs, dams and lakes and along spruits and streams.

Native of Central and South China, widely planted in Europe, whence cuttings were taken to St. Helena and South Africa. Only the pistillate tree is usually met with there or here, though a specimen bearing androgynous catkins (a hybrid?) has been collected in Bavaria (F. Schultz, herb. norm., Cent. 2, No. 1. in herb. Cantab.). Planted for shade and ornament. The wood is soft and is used for brake-blocks, mortars for stamping mielies, and for farm sleds. Foliage readily eaten by livestock; useful as greens for poultry if chopped up with their food. It is possible that in the long time which has elapsed since its introduction into South Africa, *S. babylonica* may have been pollinated by *S. capensis* or *S. gariepina*; intermediate forms should be looked for where any two of the three species occur together.

46. Salix gariepina, *Burch.*, Travels i, p. 317, t. 6 (1822); Burtt-Davy in Transv. Agric. Journ. iii, t. xii, f. 2. *S. capensis* var. *gariepina*, Anders. in part; *S. capensis*, Auct. non Thun.

A tree 12 to 50 ft. high, with pendulous branchlets sometimes 2 ft. long, but not equalling in length those of *S. babylonica*, L. Leaves of vegetative shoots, 5–7 cm. long, 6–9 mm. broad.

South Africa. Transvaal, Orange River Colony and Cape Province: Riparian along the Vaal and Orange Rivers and their larger tributaries, from near Ermelo, Transvaal (1600 m. alt.) and Aliwal North, Cape Prov. (and probably higher up), to the lower reaches of the Orange River in Bushmanland (200 m. alt.) and Little Namaqualand. Has been confused with *S. capensis*, Thun. which has shorter and broader leaves (2·5–5·5 cm. long, 9–13 mm. broad) and is not known to occur in the Orange River drainage basin. Nor does *S. gariepina*, Burch. appear to cross the karroo, though it may follow the mountains from Aliwal North southward to Albany. A specimen (*S. capensis?*) at Kew, *Atherley* 109, is of uncertain origin as the label reads "Orange River, Albany," but it does not affect the point. Other incomplete material from the Eastern Province (Sunday's River, &c.) suggests that there may be an, as yet, undescribed species, in that part of the country.

Collectors of Willows should endeavour to obtain both flowering and barren shoots from the same tree. The confusion

between our species of *Salix* is partly due to the dimorphic character of the leaves, which appears to have been generally overlooked; the first spring leaves of axillary flowering shoots are usually entire, smaller, shorter and often relatively broader than those of the barren vegetative shoots, which are developed later.

South Africa. Cape Province: Prieska Div.; banks of the Orange River, *Burchell* 1637! (*type*); Philipstown Div. near Petrusville, *Burchell* 2669! (*co-type*); Aliwal North Div., banks of Orange River, 1311 m., *Drège* b! Griqualand West: Barkly Div., Fourteen Streams, *Burtt-Davy*! Kimberley Div., Panfontein, on the Vaal River, *Burtt-Davy* 9579!. Little Bushmanland: Ramans Drift, 200 m. alt., "tree 12–25 ft.", *Pearson* 3111!. Transvaal: Bloemhof Distr., near Bloemhof, 1250 m. alt., *Burtt-Davy* 1503! near Christiana, 1250 m. *Burtt-Davy* (fine trees, *see* plate in *T.A.J.* l.c.); Potchefstroom Distr.(?) Nelson 171!

The leaves of *S. gariepina* are sometimes infested with the ornamental parasitic fungus *Melampsora mixta*. Wood soft, trunks easily hollowed out and used by natives for mortars for stamping mielies; also used for brake-blocks and sleds. Burchell records that the Hottentots made bowls and "jugs" of the wood, smearing them with fat to prevent cracking. The foliage is much browsed by live-stock in spring and early summer, before the grass is plentiful; even the dry, fallen leaves are licked up greedily in the autumn. The green leaves, chopped up, are excellent for poultry. Propagates readily from cuttings and poles.

Called 'Vaal Willow' and 'Wilde Wilge-boom'.

47. Salix Woodii, *Seem.* in Engl. Jahrb. 21, Beibl. 53, p. 53 (1896).

Shrub or small tree, up to 10 ft., riparian on the head-waters and tributaries of the Crocodile, Olifants, Komatie, 'mBulusi, and Tugela Rivers from 1250 m. down to 180 m. alt. Not known to cross the Witwatersrand, into the drainage basin of the Vaal River. *Cooper's* 3160, labelled "O.F.S.", is probably from the Natal side of the high mountains near Van Reenen's Pass, possibly from a stream flowing into the Tugela River, as otherwise the species does not appear to occur in the drainage basin of the Orange River; Mr. N. E. Brown (son-in-law of Mr. Cooper) tells me that in the Orange Free State, Mr. Cooper collected only round Harrismith and Nelson's Kop, in crossing from Basutoland to Natal, via Van Reenen's Pass.

South Africa. Natal: upper Tugela River; near Colenso, *Wood* 4970 (*type*); Transvaal: Pretoria Distr., Crocodile Riv.! Magaliesberg, *Burke* 330!, *Zeyher* 1352! *Burtt-Davy* 189!, *Leendertz* 715; Pretoria, Wonderboompoort, *Rehmann* 4532!, Derdepoort, *Leendertz* 374!; Pietersburg Distr., Koedoes River, Houtbosch, *Rehmann* 6509!; Marico Distr., Wonderfontein 4, 1100 m. alt. *Burtt-Davy* 7218, banks of Groot Marico Riv., *Burtt-Davy* 1218; Rustenburg Dist., Hex River near Rustenburg,

Nation 302 !; Barberton Distr., Komatie River at Komatie-poort, *Rogers* in *Trans. Mus. Herb.* 4759 !; *Schlechter* 11847 !. Swaziland : banks of the White 'mBulusi River, *Burtt-Davy*, 10614 ?. Imperfect specimens from Witpoortje, Witwatersrand, and Six-mile Spruit, Pa., labelled *S. Wilmsii* probably belong here, but better material is required for precise determination.

Tropical Africa. S. Rhodesia : Umtali Div.; Odzani Riv. Valley, *Teague* 125, may belong here, as may also *Munro* 2053 in *herb. Mus. Brit.*, (Victoria) and *Gibbs* 21 (Matopos), but better material is required.

Natal Willow.

48. Salix Wilmsii, *Seem.* in Engl. Jahrb. 27, Beibl. 64, p. 9 (1900).

Shrub or small tree up to 10 ft., riparian on the Komatie and Olifants Rivers and their tributaries, almost entirely on the eastern slope of the Drakensberg from about 1500 m. down to 180 m. alt., and apparently endemic to the Transvaal.

South Africa. Transvaal : Lydenburg Distr.; Spekboom River, *Wilms* 1350 !, 1351 and 1352 (*types*); *Schlechter* 3938 ?.; Burghers Pass, up to about 1500 m. alt., *Burtt-Davy* 1559 !; between Pilgrim's Rest and Sabie, *Burtt-Davy* 1584 !; Pilgrims Rest, plentiful along the Blyde River, *Burtt-Davy* !; Carolina Distr., Waterval Boven, *Rogers* in *Trans. Mus. Herb.* 12245 !; Barberton Distr., Umlomati Valley, 1200 m. *Galpin* 1278 !; Kaap Valley, near Clutha, *Thorncroft* 586 !; Pietersburg Distr. near Haenertsburg, *Nelson* 424 !, common along the Broeder-stroom near Haenertsburg, 1906, *Burtt-Davy* 5185; Zoutpansberg Distr., Spelonken, *Jenkins* in *Trans. Mus. Herb.* 8168;

This is quite distinct from *S. hirsuta*, Thun., a species belonging to the South-west Cape Region (Calvinia and Clanwilliam Divisions).

Low-veld Willow.

49. Populus canescens, *Sm.* Fl. Brit. iii. 1080.

Introduced from Europe and occasionally found as an escape from cultivation and established along streams and other wet places.

South Africa. Transvaal : Pretoria Distr.; Crocodile River, near the Magaliesberg, spontaneous along the river, 30 May, 1903, *Burtt-Davy* 188; near Pretoria, *Burtt-Davy*; Witwatersrand Distr., Roodepoort, spontaneous near the railway 26 March, 1904; Heidelberg Distr., Boschhoek, near Heidelberg, and Zuikerbosch River, near Balfour, in 1908; Standerton Distr., stream near Val Station, in 1908; Lydenburg Distr., near Lydenburg, *Burtt-Davy*.

Wood white and light, used for making matches, brake-blocks, farm sledges, &c.; does not burn readily; said to be superior to that of *P. alba*. The poles are valued on farms for rafters and roof-poles for thatched houses, sheds, native huts, etc.; much grown around farm houses and by dams and streams for these purposes.

50. Stephania abyssinica (*Dill. & Rich.*) *Walp.*, *S. hernandifolia*, Auct. non Walp.

South Africa. Pietersburg Distr.; Houtboschberg forests, *Worsdell*, Dec., 1909, *in herb. Kew*!; Modjadjies, *Rogers* 18044!.

var. *tomentella* (Oliv.) Diels, *S. hernandifolia* var. *tomentella*, Oliv., and var. *pubescens*, Szyszyl.; *Homocnemia Meyeriana*, Miers; *Stephania Meyerivana*, Harv.

South Africa. Pondoland; on the Omsamwubo (St. John's) River, *Drège* (type of *Homocnemia Meyeriana*, Miers); St. John's, *Pegler* 1541!. E. Griqualand: Clydesdale, *Tyson* 2099!. Natal: Alexandra County, Dumisa, *Rudatis* 1408!; between Umzinto and Ifafa, *Wood* 3016!; Coldstream, *Rehmann* 6895!, without precise locality, *Gerrard* 1468, *Cooper* 904–12. Transvaal: Lydenburg Distr., near Lydenburg dorp, *Wilms* 7; Ermelo Distr., Mavieriestad, *R. Pott* 5105!. Swaziland: M'babane, 1500 m., *Bolus* 11679.

51. Antizoma angustifolia, *Miers ex Harv.* Fl. Cap. i. 13 (1859–60), *Cissampelos angustifolia*, Burchell, Travels, i. 389 (1822); *C. calcarifera*, Burch. op. cit. ii. 266 (1824); *Antizoma calcarifera*, Miers ex Harv. l.c.; *A. Burchelliana*, Miers l.c.

South Africa. Griqualand West: Herbert Div.; between Spuig-slangfontein and the Vaal Riv., Oct. 25, 1811, *Burchell* 1717, (*type*!); Lower Campbell, Nov. 16, 1811, *Burchell* 1795! (type of *C. calcarifera*, Burch.) 1795 bis (type of *A. Burchelliana*, Miers); St. Clair, *K. Orpen* 214!; Hay Div., between Klipfontein and Knegts Fontein, *Burchell* 2170!. British Bechuanaland: Maadji Mt., *Burchell* 2369!; Kuruman Div., between the sources of the Kuruman Riv. and Kosifontein, *Burchell* 2529!, plains south of Takun, *Burchell* 2229!. S. W. Protectorate: between Nauchas and Areb, in plains of granite sand, *Pearson* 9014!. Transvaal: Waterberg Distr., Klippan, *Rehmann* 5313 (a pubescent ♀ specimen, resembling *A. Harveyana*, Miers.).

The type specimen of *A. Burchelliana* does not agree with the description in the *Flora Capensis*, the spine being only 1–2 mm. long.

52. Antizoma Harveyana, *Miers*, op. cit. p. 12.

South Africa. Transvaal: Pretoria Distr.; Crocodile River, Magaliesberg, Nov. 1841, *Burke* s.n., (*type*!) *in herb. Kew*, *Zeyher* 9 *in hbb. Kew and Camb.*!, Aapjes-poort, *Rehmann* 4022!, Groenk'oof, *Burtt-Davy* 18844!, Rooiplaat, *Leendertz* 785!; "Pretoria Distr.", *Dr. Visser*, T.M.H. 4694!; Waterberg Distr., Badsloop, 1400 m. *Schlecht.* 4282!. Orange Free State: Winburg Dist., Vet Riv., March 1841, *Burke* 448!; Boshof Distr., Smitskraal, *Burtt-Davy* 10864. Natal: without precise locality, *Gerrard* 1180!

53. Cocculus hirsutus (*L.*) *Diels* in Engl. Pflanzenreich, 46 heft (iv. 94) p. 236 (1910); *C. villosus*, DC. Syst. I. p. 525.

South Africa. Transvaal: Pietersburg Distr.; Houtboschberg forests 1200–1700 m., June, 1906, *Burtt-Davy* 2592!;

Macoutsie R., July, 1917, *Dr. Breyer in Transv. Mus. Herb.* s. n.; Zoutpansberg Distr., Kobbi, 900 m. *Schlecht.* 4623 !

54. Cissampelos mucronata, *A. Rich.*, Diels. op. cit.; C. *Pareira*, Dur. and Schinz, non L.

South Africa. Transvaal : Barberton Distr.; twining amongst low bushes on river banks, Queen's River, *Galpin* 642 !, Kaap River, *Bolus* 7634. S. Rhodesia : " S. African Goldfields " Tati (?) 1870, *T. Baines in herb. Kew.*

Called " Msissi " in Zambesia.

55. Cissampelos torulosa, *E. Mey.*, Fl. Cap. I. p. 11 (1859–60). *Menispermum capense* Thun. Fl. Cap. p. 402 (1823), not *Cissampelos capensis* Thun. Prodr. p. 110 (1800).

South Africa. Transvaal : Pietersburg Distr.; Houtbosch, *Rehmann* 5956 !, *Pott* 4756 !, Marovounge Bush near Shilouvane, *Junod* 867 !; Lydenburg Distr., Pilgrims Rest, *Rogers* 14,748 in *Trans. Mus. Herb.*; Barberton Distr., *Pott* 5610 !. Cape Prov. : " in sylvis," without precise locality, *Thunb.* (type of *Menispermum capense*, Thun.); Knysna Div., " Koratra " (Karratera River) *Drège* a (type of *C. torulosa*). Natal.

56. Ranunculus pubescens, *Thun.*, Prodr. 94, 1800; Fl. Cap. 443, 1823; *R. pinnatus*, Harv., Fl. Cap. i. p. 6; non Poir ? (Poiret gives the type locality of his *R. pinnatus* as " Les Indes."

South Africa. Transvaal: common in vleis and damp grassy places; Pretoria Distr., Aapjes Riv., Oct. 1841, *Burke* s. n. ! in herb. Kew, *Burtt-Davy* 824, *Leendertz* 980 !, Lydenburg, *Wilms* 5 !; Ermelo, *Burtt-Davy* 17,438 !; Waterberg Distr., Potgietersrust, *Leendertz* 1420 !; Pietersburg Distr., The Downs, *Rogers* 21888 !; Vereeniging, *W. Leslie* in *Trans. Mus. Herb.* 5685. Orange Free State !, Natal !, south to the Eastern Cape Province, and west to Cape Town.

Tropical Africa. Angola, S. Rhodesia, north to Abyssinia, Fernando Po, Madagascar.

The expressed juice, when fresh, was in the early days of the South African Dutch Colonists recommended for application in cancerous ulcers, whence the vernacular name " Kankerbladen."

var. **glabrescens,** *Burtt-Davy*; *R. pubescens*, Thun., affinis, sed herba tenuior, sub-glabrescens.

South Africa. Transvaal : Vereeniging Distr.; Burttholm, Uitgevallen 197, *Burtt-Davy* 17682 ! (*type*) *in herb. Kew*, and 17164 !; Bethal, *Pott* 3665 !

Leaves eaten by cattle in spring and at other times when grass is scarce !

57. Ranunculus Drouetii, *Godr. ex F. Schultz*, Arch. Fl. de Fr. et Allem., 10, 1842–54. (*R. aquatilis*, var. *Drouetii*, Hook. f., *R. rigidus*, Godr. non Poir.).

South Africa. Transvaal : still pools of the Vaal River; Ermelo Distr., *Burtt-Davy* 1875 !, Standerton *Pott* 3973 !, Vereeniging *Pott* 3892 !, Bloemhof (?) *Nelson* 218 !, Mooi River at

Potchefstroom Trout Hatchery, *Burtt-Davy* ! Orange Free State : Boshof Distr., Vaal River at Smitskraal, *Burtt-Davy* 10903 !

Valued for harbouring fish food in trout streams ! .

58. Knowltonia transvaalensis, *Szyszl.*, Polypet. Rehm. p. 99. (1887).

South Africa. Transvaal : Pietersburg Distr. ; Houtbosch, *Rehmann* 6402 ! (*type*), *Jenkins* in *Trans. Mus. Herb.* s. n. ! ; Barberton Distr., Saddleback Range, Barberton, grassy mountain sides, 1200–1500 m., abundant, flowering Sept.-Nov. 1889, *Galpin* 460 !

59. Knowltonia multiflora, *Burtt-Davy*, sp. nov. ; *K. transvaalensi* affinis sed foliorum pinnis integris vel irregulariter et leviter lobatis 7–9 cm. longis, 4–6 cm. latis, scapo multi-(12–15) flora ; petalis minoribus 12 mm. longis differt.

South Africa. Transvaal : Lydenburg Distr., Mac-a-Mac, 1525 m. *C. Mudd* s.n. *in herb. Kew* (type). A very scrappy specimen in herb. Kew, collected by *Atherstone* near Lydenburg, Dec. 1873–June 1874, s.n., labelled "*K. gracilis*, DC. ?," and a specimen from Sabie Falls, south end of gorge, in sandy loam, *Burtt-Davy* 1547 probably belong here.

60. Knowltonia canescens, *Szyszl.* var **Pottiana,** *Burtt-Davy*, var. nov. a typo foliorum segmentis sub-glabrescentibus et marginibus integris, petiolis longioribus (7–11 cm. longis) et scapis pubescentibus nec canescentibus, differt.

South Africa. Transvaal : Lydenburg Distr. ; Dullstroom, *F. Noomè* in *Trans. Mus. Herb.* 20803 ! (*type*).

XLV.—MISCELLANEOUS NOTES.

Mr. M. Park, A.R.C.S., has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Mycologist in the Department of Agriculture, Ceylon.

Mr. P. R. Dupont, Curator of the Botanic Station, Seychelles, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Director of Agriculture, Mauritius.

Mr. A. W. C. Budge, M.M., B.Sc., Mr. J. E. Gray, B.A., Captain J. O'N. Hewitt, A.R.C.S. (Ireland), and Captain J. R. Mackie, B.Sc., have been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Superintendents in the Agricultural Department, Nigeria.

Mr. N. E. Brown, A.L.S. (*K.B.* 1914, p. 227), has this year been awarded, on the recommendation of Dr. I. B. Pole Evans, and by the unanimous decision of the Council of the South

African Biological Society, the Captain Scott Memorial Medal given for scientific research in South Africa, in recognition of his valuable work on the South African Flora.

The Medal, which was forwarded to the Director with the request that he should make the presentation on behalf of the Council, was handed to Mr. Brown at a meeting of the Herbarium staff which took place on Monday, 7th November, 1921.

Additions to the Mycological Collection.—Through the generosity of Dr. W. A. Murrill, of the New York Botanical Garden, the Kew Herbarium has received a very valuable addition. Early this year Miss Wakefield visited New York in order to study there the rich collections of *Polyporaceae* from the American Tropics, with special reference to her own West Indian collections. While there Dr. Murrill suggested that she should select for the Kew Herbarium portions of the type material of species described by him. This was done, and there are now incorporated in the Kew collections co-types or authentic material of over 200 species previously unrepresented there.

The collection is especially valuable because in recent years a considerable amount of work has been done in the United States on the fungi of the American Tropics, very little of which is represented at Kew. A few years ago Dr. F. L. Stevens presented a set of Porto Rican fungi, chiefly Meliolas, and various odd specimens have been acquired by exchange or gift. Dr. Murrill's gift is a further most important contribution towards remedying the deficiency in this respect.

Recently a further noteworthy addition to the fungus herbarium has been made by the purchase of a complete set of Dr. Petrak's *Fungi polonici*, *Mycotheca carpatica*, and *Fungi albani et bosniaci*. The set comprises in all 1050 specimens, chiefly micro-fungi, and many of them new, from countries which have been little explored mycologically. E. M. W.

Presentations to Museums.—The following miscellaneous specimens have been received in addition to those previously recorded in the *Bulletin* :—

Lady Hooker, Bath.—Walking stick made from a section of an Oak Pile from Old Kew Bridge.

Lady Mary Lockyer, Penywern Road, London.—Pastel portrait of Miss M. H. Mason whose collection of water-colour drawings of the vegetation of South and East Africa, presented to the Royal Gardens, is exhibited in Museum No. IV.

Mr. James Mowatt, Grayshott, Hants.—Photograph and section of an old Crab-apple tree that marked the boundary between Surrey and Hants.

Mr. W. J. Marlow, Hampton Court Gardens.—Sections of abnormal growths of Common Lime with Mistletoe attached.

Messrs. F. H. Ayres, Ltd., Aldersgate Street, London.—A collection of sports requisites in various stages of manufacture.

Mr. A. P. Payne, per Mr. A. E. Bernays, Priory Road, Kew.—Tray made of the wood of Queensland Silky Oak (*Grevillea robusta*).

Lt.-Col. L. Bickle, Sydney, N. S. Wales.—Samples of flour and biscuit made from Prickly Pear (*Opuntia* sp.).

Curator, Botanic Garden, Dominica.—Twelve photographs of the Dominica Botanic Gardens.

The British North Borneo Co., London.—Seeds and fatty oil of *Aleurites triloba*, also samples of Indigo, Jute, Manila, Hemp, etc., from the International Rubber Exhibition.

Mr. H. F. Macmillan, Ceylon Court, Inter. Rubber Exhibition.—Trunks of *Hevea brasiliensis* to illustrate methods of tapping, samples of smoked and unsmoked rubber.

Netherlands Colonies Court, Inter. Rubber Exhibition.—Trunk of *Hevea brasiliensis* to illustrate method of tapping in Sumatra.

Messrs. Harrisons & Crosfield, London.—Pruned tea bush, smoked sheet rubber and four rubber stumps.

Gold Coast Court, Inter. Rubber Exhibition.—A large and varied collection of vegetable economic products.

Mr. A. Luttrell, Dunster Castle, Somerset.—Planks of Douglas Fir and Brown Oak.

Messrs. W. Le Lacheur & Son, London.—Samples of coffee in husk and cleaned from Costa Rica.

Assistant Curator, Botanic Garden, Dominica.—Samples of rubber from *Hevea brasiliensis*.

Mrs. Louisa S. Harvey, West Kensington.—Portrait in oils of Hewett Cotterel Watson, author of various works on Botany. Born 1804. Died 1881. His herbarium is at Kew.

Mr. L. Oliver, Weston-super-Mare.—Pod of *Cassia Fistula* from Burma.

Mr. H. J. Elwes, F.R.S., Colesborne, Gloucestershire.—Veneers of *Sequoia sempervirens* and Manchurian Ash.

Curator, Botanic Gardens, Brisbane.—Cones of *Araucaria Bidwillii* and *Agathis robusta*.

Hon. Mrs. Evelyn Cecil, Poole, Dorset.—Transverse section and plank of *Cupressus macrocarpa*.

Mr. F. E. Sullivan, Alverstoke, Hants.—Model of a boat, made of Tree-fern stem.

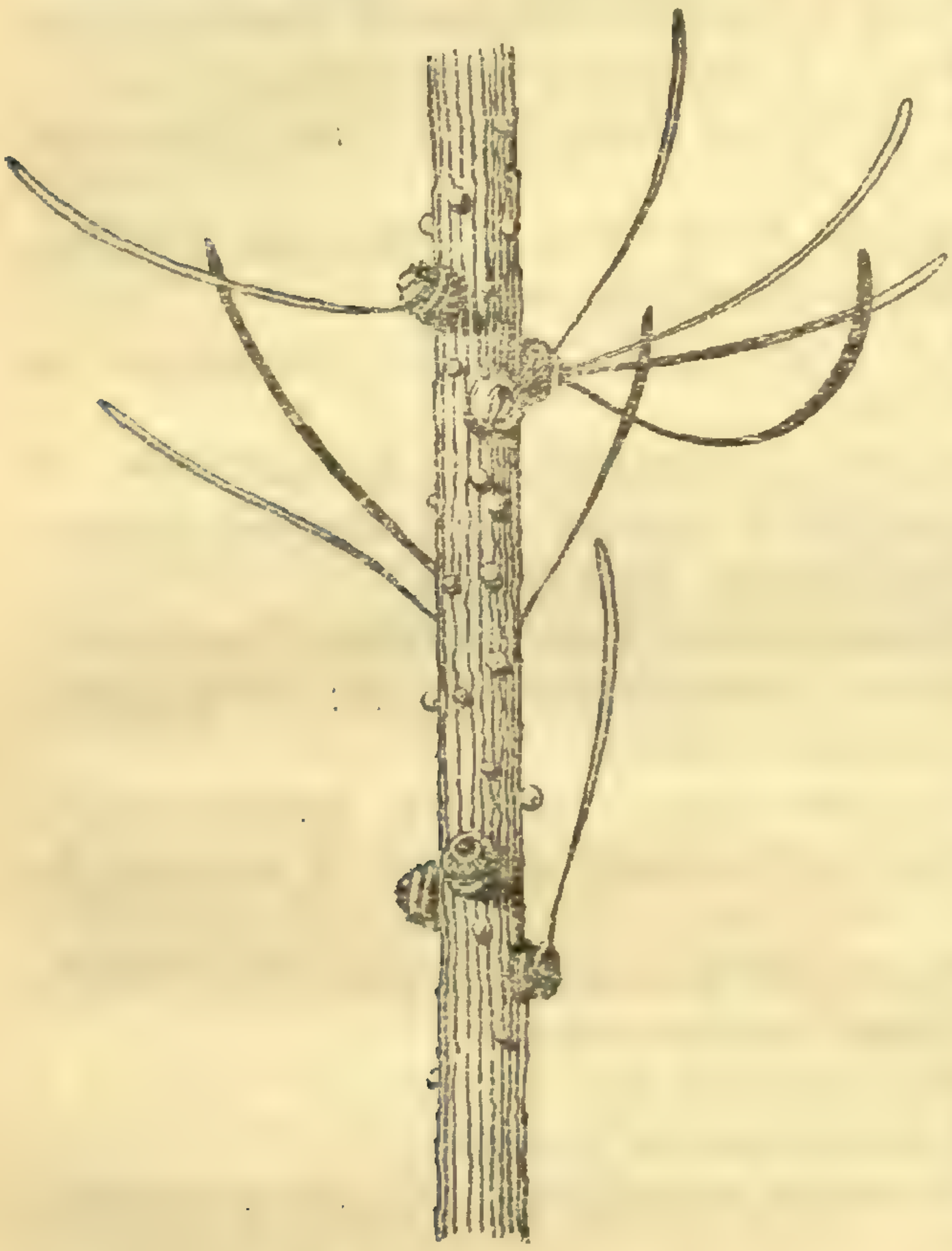
Mr. G. Guillet, Kensington.—Several old engravings of views in the Royal Botanic Gardens, Kew.

Mr. P. Scarborough, Lombard Street, London.—Portion of an old Greenheart Pile, from a wharf at Millwall.

J. M. H.

Resinous Exudation from Branches of Larix occidentalis.—Hough in American Timbers vol. x, p. 53, records under *Larix*

occidentalis that "A sweetish substance resembling dextrin in properties, exudes in abundance from wounds in the trunk of this tree, and is gathered and eaten by the Indians." Until recently nothing appears to have been seen of any exudation from the trunk or branches of this species in Great Britain, but during the present year the branches and trunks of young trees, about 10 years old, at Kew, have become encrusted with resin, which in the early stages appears as small, transparent, greyish globules. The exudation has a slightly resinous taste but no sweetness can be detected. Whether the condition is due to the abnormally fine weather experienced during the past months or whether it will continue will be interesting to watch.



W. D.

Coffee (*Coffea arabica* and commerical varieties) **in Guatemala and Costa Rica.**—A Report on a Visit to Guatemala and Costa Rica to Investigate Methods of Cultivation of Coffee and Its Diseases and Pests by Mr. A. D. Le Poer Trench, Senior Coffee Officer, Kenya Colony, has been received at Kew from the Colonial Office. It should prove of value to the planters in East Africa as the author includes useful information on the three much-discussed subjects of pruning, shade and manuring.

Costa Rica and Guatemala Coffee usually occupy a prominent position in the market quotations and in the main the methods explained may accordingly be relied on—though as rightly inferred in the report, no hard and fast rules can be laid down and certain variations may be advisable in accordance with local conditions.

Under pruning, a new system called "Agobiada" is described as becoming very popular in Guatemala where it has been in operation for fifteen years, together with the old "Capping" System (cutting or pinching out the top of the young plant when about 12–15 in. high) common also in Costa Rica. The name "Agobiada" means "bent over" and under the system "no capping or topping is ever done; the trees are left to grow any

height, the stems will bend outwards by the weight of the crop and allow plenty of air and light into the tree." Briefly the chief advantages claimed over capping are. (1) It requires less labour for pruning and handling. (2) The tree is more pliable and easily bent, hence extra facility in gathering the crop; (3) The formation of old wood is avoided, so there is less chance of the dreaded disease *Phthora vastatrix, d'Herelle,* attacking old trunk stems.

It is stated that shade has been found necessary when growing Coffee in Central America, except at high elevations; at 2000 ft. and under, heavy shade is used. "The chief shade-trees used are "Banana," *Inga vera*, Willd.—the tree most in favour—"Madre de Cocoa" or "Madera" (*Gliricidia maculata*, H.B. & K. syn. *Robinia maculata*, H.B. & K.) and *Erythrina costaricensis*, M. Micheli—seen growing at very high elevations and suggested as likely to do well in certain districts of East Africa where a trial of the *Inga vera* and other shade trees is proposed.

In reference to manuring it is stated that "coffee has been grown in the countries mentioned for nearly a century. The soil in which it is cultivated is characterized by its richness in humus, due in part to original forest land, leaf mould from the plants themselves and shade trees; but the need for manuring of some description has been evident. It is usually deep and sometimes stony, in colour almost black when damp and the subsoil is similar to the red forest soils of Kenya." Lime and natural manures are recommended in preference to artificial manures. Only very recently the Director forwarded a memorandum (copy appended with further references to literature) on this subject to a firm in London on behalf of a large Coffee Estate owner in Costa Rica, who had found the matter, owing to the age and condition of the trees on his plantation to be one for urgent consideration.

Particulars of Cultivation, Harvesting, Preparing, Machinery and Diseases are also reported on.

Manures for Coffee Plantations.—There appears to be no information available as to the effect over a sufficiently long period, of the application of chemical manures on Coffee, to admit of a favourable opinion or a recommendation for general use being given. Such active artificial manures as Sulphate of Ammonia, Sulphate of Potash, Nitrate of Soda, Superphosphate, etc., are undoubtedly of value for annual crops, where immediate results are desirable and the temporary character of the manure is of secondary consideration; but for Coffee—or any other perennial plant—where a slower and more lasting effect is desirable—a similar value has not been established. It has in fact been stated that "most decidedly the active artificial manures would not be suitable for the coffee tree" (Sir John Lawes, "Manures and Coffee," in Bull. Bot. Dept. Jamaica, March 1897, p. 57)

and much difference of opinion seems to prevail in all coffee growing countries on this point.

The manures, however, that may be safely recommended, are those of an organic character, including prunings, leaves, weeds, coffee-pulp and other refuse obtained in the process of preparation of the bean, farm-yard manure, green-manures, bone, dried blood, oil-seed cake, guano, fish manure, to which may be added the inorganic substances, wood-ashes and lime.

Farm manures and green manures, may not be practicable on all plantations; but in respect of the first, the suggestion of rotting down straw to take its place may be worthy of consideration—this is effected by a process recently discovered as the result of many years' investigation. Humification of the straw is brought about by a fermenting organism; but wet straw alone will not rot down, and some active form of nitrogen to start the process is required—this may be supplied by the urine from stock or by passing sewage through a filter bed made up of straw. At Wainfleet (Lincolnshire) this method has been applied to deal with the sewage from a camp of some 200 men, and further trials are in progress to work out a method of making farmyard manure on a large scale without animals (see "The Present Position of Research in Agriculture," by Sir Daniel Hall, in Journal of the Royal Society of Arts, April 1st, 1921, p. 305).

The selection, however, of any of the manures mentioned can only be decided on a knowledge of local conditions and under experiment, especially as regards convenience and cost.

A manure of considerable value may be made by mixing the pulp with bone-meal (in the proportion of about one part bone-meal and twenty parts coffee-pulp) together with any general refuse from the plantation, heaped or buried under protection from sun and rain for several months—after the usual method of preparing manure heaps. When sufficiently decayed it may be dug in round the trees, without injury to the roots if possible, or laid on as a mulch.

The Pulp together with parchment and other refuse from the factory, is of value because of the Nitrogen, Phosphoric acid, Potash and Lime it contains and the Bone-meal for the Phosphoric acid, Lime and Nitrogen contained in it. The percentages of the constituents mentioned in the coffee pulp are considerably higher in fresh material than after exposure to sun and rain for several months, and it is important to conserve them as above described. Any wood-ashes that may be available from burning rubbish on the plantation might be put into the manure heap, to increase the supply of potash. Slaked lime when this is found necessary, (and tropical soils are very often deficient in this respect), might be applied with advantage by distributing it over the whole plantation a few months before applying the mixed or other manures, at the rate of about 15 cwt. per acre or with trees 9 ft. by 9 ft. this would be approximately 3 lb. per tree.

Some guide to the requirements of the coffee trees may be found in the following table, from "Le Cafè: Dans L'Etat de Saint Paul (Brésil)," by A. Lalière (Paris, 1909) p. 122 :—

The annual requirements of 1,000 coffee plants at different ages, of nitrogen, potash and phosphoric acid—the most important constituents taken up by them from the soil, are—

Age of Tree.	Nitrogen.	Potash.	Phosphoric acid.
	lb.	lb.	lb.
First 4 years - - -	9·87	23·62	2·49
From 5 to 8 years - -	35·7	76·92	19·57
From 9 to 20 years - -	28·87	45·83	15·76
After 20 years (old trees) -	5·09	30·53	9·48

Some further particulars will be found in the following works :—

"Potash : Its Distribution, Commerical Sources and Agricultural Value", by Alfred Smetham, F.I.C., pp. 1–28, reprinted from the Journal of the Royal Lancashire Agric. Soc. for 1915 (Geo. Toulmin & Sons, 127 Fishergate, Preston).

"Le Café : Culture" &c., by Henri Lecomte, "Chimie du Café et du Cafier", pp. 207–224 (Georges Carré et C. Naud 3, Rue Racine, Paris, 1899).

"*Coffea arabica* ; in "The Commerical Products of India", by Sir G. Watt, "Manuring and Manures," pp. 378–380 (John Murray, Albemarle St. London, 1908) with references to other works on the subject.

"Kaffee-Dungungsversuche" in Guatemala, by Gustav Holmrich, pp. 1–20—Reprint from "Tropenpflanzer", Vol. V, No. 12, 1901.

"Versuche uber die Verwendung von Kunstdunger in der Kultur des Kaffees," by Gustav Helmrich, p. 1–36—Reprint from "Tropenpflanzer," Beihefte, No. 4, 1908.

"Peat-Moss Litter Manure" : with an Analysis of Farm-yard Manure, Kew Bull. No. 8, 1911, pp. 349–351.

"Green Manures", Kew Bull. No. 1, 1914, pp. 21–24.

"Coffee; Its Cultivation and manuring in South India", by R. D. Anstead, Dept. Agric. Mysore, Bull. (General Series) No. 6, 1905.

"Artificial Farm-yard Manure", by H. B. Hutchinson and E. H. Richards, Rothamsted Experimental Station, in Journ. Ministry of Agric. xxviii, August 1921, pp. 398–411.

Latex Yield from Individual Rubber Trees.—In the Tropica. Agriculturist, vol. lvii., No 2. pp. 81–83 we notice three short accounts of the yeild of latex from individual trees of *Hevea brasiliensis* and also results of tapping experiments. In a field of $61\frac{3}{4}$ acres where thinning had taken place until 80 trees per

acre were left at the time of the census in December 1920, the following results were obtained :—

(1) Trees yielding latex into the cups - - -	1428	28% of total.
(2) Trees yielding scrap only	2605	50 ,, ,,
(3) Trees not yielding anything - - -	1078	20 ,, ,,
(4) Trees not tapped (treated for brown bast on all three segments) -	104	2 ,, ,,

The planter who furnished these figures states that he has been of opinion that on many estates "75% of the crop is obtained from 25% of the trees" and these figures certainly corroborate his views. It would be interesting to know the result of a census taken at a later date, with the object of finding out whether the same individual trees are always bad yielders; but from Mr. Stafford Whitby's results given in the Annals of Botany (see *Kew. Bull.* 1920, p. 113), it would be expected to be the case. From a similar census made at the Rubber Experiment Station, Mooply, during November and December 1920 over 1266 trees, the following figures were obtained :—

	% of total.
(1) Trees yielding scrap only - - -	19·4
(2) ,, ,, up to $\frac{1}{2}$ oz. of latex - -	29·6
(3) ,, ,, from $\frac{1}{2}$ to 1 oz. of latex -	26·8
(4) ,, ,, ,, 1 to 2 ozs. ,, -	17·9
(5) ,, ,, ,, 2 to 3 ozs. ,, -	4·1
(6) ,, ,, ,, over 3 ozs. ,, -	2·2

Such information may be profitably borne in mind when thinning out. In the case of the first set of figures the 2% of trees with brown bast and the 20% not yielding anything might be thinned out straight away, provided none recover enough to be worth the money spent on them. When further thinning became necessary some of the 50% which yield scrap only could be removed. In this case, however, the trees have already been thinned down to 80 to the acre.

The above results emphasise the urgent need which exists for work to be done on seed selection and plant breeding in *Hevea* which it is intended to carry out at the Rubber Experiment Station, Mooply, and elsewhere.

In reference to Tapping Tests and Bast Examination of *Hevea* Plants from selected seed, Mr. C. Heussen records (in Archief Voor de Rubbercultuur June 1921), that on the Bijawak Estate a plot was sown in 1915 with seed from the 1914 crop, the offspring of four vigorous and high-yielding mother trees. In September 1918, 100 daughter trees were selected of which 34 were from mother tree No. 1, 20 from No. 2, 23 from No. 3 and 23 from No. 4. Up to September, 1920, five tapping tests,

each of a month's duration were made, three determinations of the number of latex vessels and three of stem girth and bark thickness one meter above ground. The five tapping tests show an increase based on equal areas of 16·8 % over the old plantings. Based on calculations for individual trees those selected gave an increase of 75 %. The offspring show great variation in production. It seems desirable in selecting mother trees, that vegetative vigour should go hand in hand with high production. The results show that "thinning out trees based on the number of latex vessels does not yield satisfactory results" and that a "thinning out on the basis of tapping tests and production measurements is preferable."

Experiments in tapping have already been urged as having an important bearing on the choice of trees to be used for selection (see *Kew. Bull.* 1920, p. 118), and the records made by Dr. De Jong (quoted in the "Trop. Agric." from "Arch. v. Rubbercultuur," June 1921),though not advanced here as conclusive, are of interest as being based on the more up to date methods. Earlier systems of tapping (see *Kew. Bull.* 1898, p. 260 : Add. Ses. vii., p. 95 : ix., p. 587), including the native Amazon method, spiral, full herring-bone &c. are becoming more or less obsolete. The experiments in question were carried on over a period of more than 7 years on the principle of (1) "One left cut at 1·10 metre high on a quarter of the circumference, tapped twice daily; (2) two left cuts 50 cm. apart on a quarter; two left cuts 50 cm. apart on a quarter; two left cuts 75 cm. apart on a third; and three left cuts 50 cm. apart, all tapped daily, gave almost the same yield. The yield figures for the first $2\frac{1}{2}$ years, both for the trees which remained healthy throughout the experiment and for those which later developed disease ('brown bast') show that there was no difference in the rubber producing ability," and it is further stated that "these tapping systems which use the bark to a height of 1·60 m. have lost fewer trees than the tapping system in which the highest cut was placed at only 1·10 metre."

The Journal of the Botanical Society of South Africa.—We have received Part vii. of the Journal It is largely concerned with the National Botanic Gardens at Kirstenbosch near Cape Town, probably the most important foundation for the advancement of botany established in recent times. The flora of South Africa is so beautiful and so distinct from any other, especially in regard to its bulbous plants, succulents, heaths, and pelargoniums, that the progress of the new headquarters for its study and elucidation will be watched with sympathetic interest all the world over.

To the Journal Mr. A. R. E. Walker, of the Geological Department of Cape Town University, contributes an article on the geology of Kirstenbosch, very interesting for the informa-

tion it gives of the rocks, soils, streams and contours of the site. Mrs. L. Bolus gives an account of the mammals at Kirstenbosch and an illustrated one of the South African *Proteaceae*—another family which forms one of the most characteristic and conspicuous features of the flora of the South-western districts. It is gratifying to learn from an article by the Curator, Mr. J. W. Mathews, that many of this family are established and thriving in the gardens. Mr. Mathews also gives an account of the principal work in progress at Kirstenbosch from which it is evident that an active policy is being carried out. The formation of a Pelargonium Garden and the restoration of the Silver Tree forest are items of particular interest.

The Director of Kirstenbosch, Prof. R. H. Compton, contributes a suggestive article entitled "The Karroo Garden at Whitehills." In this he points out that, unrivalled as is the site of Kirstenbosch for the purposes of a Botanic Garden in the matters of soil, climate and landscape, neither it nor any other possible site could provide conditions suitable for the successful cultivation of all classes of plants native of South Africa. Amongst those requiring special conditions is the remarkable vegetation of the arid regions known as the Karroo, where grows probably the richest variety of succulent plants in the world. It is regrettable to learn that owing to various causes arising from the operations of mankind, many of these wonderful plants are disappearing. Some probably are already extinct. Owing to the efforts of Prof. Compton, Sir William Hoy (General Manager of Railways), and others, and especially to the generosity of the late Mr. James D. Logan and his family, who presented a piece of land 20 morgen in extent close to the railway at Whitehills, near Matjesfontein, a garden for the preservation and cultivation of Karroo plants is in process of formation. The site is already rich in species growing naturally there and to it, as time and opportunity permit, will be transferred plants from other localities of the Karroo. The area is being fenced round and there is thus provided an opportunity for preserving and studying under natural conditions many species of xerophytic plants in danger of extinction. It is hoped that other similar "sanctuaries" may be established. Horticulturists as well as botanists would be glad to know it had been done for the beautiful "Cape heaths", a family which once filled an important place in ornamental conservatory gardening in the British Isles.

W. J. B.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 10] [1921

XLVI.—A CONTRIBUTION TO THE FLORA OF NORTHERN NIGERIA.

PLANTS COLLECTED ON THE BAUCHI PLATEAU BY MR. H. V. LELY.

J. HUTCHINSON.

In the account of the visit of the Assistant Director to the Cameroons and Nigeria (*Kew. Bull.* 1921, 225–243), it was noted that Mr. H. V. Lely, Forestry Officer, Naraguta, Northern Nigeria, was investigating the flora of this botanically little known region, and had forwarded to Kew a number of herbarium specimens. Mr. Lely has fortunately been able to make several further contributions, and has already brought together a very good representative collection, especially of the herbaceous vegetation. His activities have been confined to that part of Northern Nigeria described by Falconer* as "the mysterious Bauchi plateau, the home of innumerable pagan tribes, whose precipitous walls on the South and West long marked the limit between the known and the unknown."

This interesting plateau, which rises to a height of 4000–4500 ft. above the sea, is veritably a *terra nova* to the botanical collector, and, as might be expected, there are amongst Mr. Lely's plants many new species and quite a number of new records of considerable phytogeographic interest. For our knowledge of the flora of many parts of the interior of Tropical Africa we have hitherto had to depend mainly on explorers and hunters, whose visits were necessarily at the most favourable time of the year, and to most of whom plant collecting was a haphazard and minor consideration, attended by a considerable amount of extra labour and baggage. So that an extensive collection of plants from a resident in the interior, and that resident a forest officer, is particularly valuable and sure to yield interesting results.

As Mr. Lely himself writes, the majority of the plants in Northern Nigeria, owing to the excessive dryness of the climate,

* J. D. Falconer, Geology and Geography of Northern Nigeria, p. 3 (1911).

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pass through their life cycle at a great rate, especially the herbaceous vegetation, and in order to obtain a good representative collection it is necessary to carry on field work for a whole season. Up to the present Mr. Lely has collected nearly six hundred specimens* and there is promise of more to follow. The fact that these represent about four hundred species of plants shows the care the collector has taken in order to avoid duplication of specimens.

The following list of species indicates the large number of interesting new records for the flora of Northern Nigeria and their previously known distribution. It should be noted that the flora as represented by these examples is much more closely related with that of the East African plateau, the Zambesi Basin, and Angola than with the flora of Upper Guinea as a whole.

Species now recorded from Northern Nigeria.	Previously known only from :—
Polygala Volkensii, Gürke - -	- Nyasaland, Rhodesia.
Monotes caloneurus, Gilg - -	- S.E. Sudan, Angola.
Kosteletzkya Büttneri, Gürke -	- S.E. Congo, Angola.
Cissus crotalarioides, Planch. -	- Jurland, Nyasaland.
Anaphrenium pulcherrimum, Schweinf.	East and S.E. Tropical Africa.
Tephrosia radicans, Welw. - -	- N.W. Rhodesia, Angola.
Desmodium dimorphum, Welw. -	- Angola to Usambara.
Adenodolichos macrothyrsus, Harms.	- Jur- and Bongoland.
Eriosema holophyllum, Bak. f. -	- Niamniamland.
Eriosema sparsiflorum, Bak. f. -	- Jurland.
Eriosema griseum, Bak. - -	- Angola and Bongoland.
Eriosema cordifolium, Hochst. -	- Abyssinia.
Osbeckia postpluvialis, Gilg -	- Jurland.
Diplolophium abyssinicum, Bth. & Hk. f.	Abyssinia to Uganda.
Sabicea brevipes, Wernham- -	- Togoland.
Pentanisia Schweinfurthii, Hiern.	- E. Africa.
Fadogia obovata, N.E. Br. - -	- N. Nyasaland and N.W. Rhodesia.
Gutenbergia Ruppellii, Sch. Bip.	- Abyssinia and Kenya Colony.
Vernonia oocephala, Bak. - -	- N. Nyasaland.
Senecio Hochstetteri, Sch. Bip. -	- Abyssinia and East Afr. Mts.
Picris humilis, DC. - - -	- Senegal.
Kanahia glaberrima, N.E. Br. -	- East Africa and Angola.
Sopubia parviflora, Engl. - -	- Jurland and Angola.
Utricularia tribracteata, Hochst. -	- Abyssinia and Somaliland.
Utricularia rigida, Benj. - -	- Sierra Leone, W. French Guinea.

* When this paper was nearly completed a further hundred specimens from the eastern parts of the Bauchi province were received from Mr. Lely. These are not included in the present paper.

Species now recorded from Northern Nigeria.	Previously known only from :—
Utricularia micropetala, Sm. -	- Sierra Leone.
Lepidagathis mollis, T. Ands. -	- Uganda.
Geniosporum paludosum, Bak. -	- E. Trop. Africa.
Thesium leucanthum, Gilg - -	- Angola.
Angraecum Kotschyanum, Reichb. f.	- Nile Land to Nyasaland.
Brachycorythis pubescens, Harv. -	- Kenya Colony to Natal and in Angola.
Habenaria Mannii, Kk. f. - -	- Cameroon Mtn.
Aristea angolensis, Bak. - -	- Angola.
Chlorophytum pusillum, Schweinf.	- Jurland.

The greater portion of Mr. Lely's collection is included in the present paper, but a few specimens still remain for more critical examination and comparison with other herbaria. Amongst these are a number of striking Orchids, mostly species of the genus *Habenaria*, which is so largely represented in the Tropical African Flora. I have, however, ventured to describe two species of Orchids which appear to be new, namely, *Eulophia propinqua* and *Satyrium nigericum*, the latter genus not having been recorded previously from Upper Guinea. The ground orchids of Northern Nigeria, and of the Bauchi plateau in particular, are worthy of special study, and further contributions of them from Mr. Lely would probably provide material for a separate paper. It would, however, be necessary to compare them critically with the numerous new species described in Berlin from the Cameroons, and with Chevalier's collections in Paris, few of which are represented in this country. In the case of these two new Orchids, and, indeed, with nearly all the *new species* of the collection, the affinity is again decidedly with plants native of East and South-East Tropical Africa, and not with Upper Guinea.

For the preliminary determination of many of the specimens enumerated in the following list I am much indebted to Miss K. Pearce and Mr. E. G. Dunk, whilst Dr. Stapf, Mr. C. H. Wright and Mr. W. B. Turrill have brought their special knowledge to bear on the *Lentibulariaceae*, Ferns and *Acanthaceae* respectively, and Mr. Turrill has taken great care in the determination of the Ceropegias, including the striking *C. Ledermannii* figured on p. 388. For the more artistic text figures (Nos. 3, 6, 7, 10) I am greatly indebted to Mr. A. Kellett.

The following abbreviations have been used :—

F.T.A. = Flora of Tropical Africa.

Holland = Holland, Useful Plants of Nigeria, Kew Bull. Additional Series IX.

Only occasionally do Mr. Lely's notes refer to economic properties; but as many of the plants enumerated are recorded

as having such, I have thought it sufficient to refer to Holland's work rather than repeat his published statements. All the plants mentioned were collected by Mr. Lely during the present year (1921) on the Bauchi Plateau, the various localities and date of collection being clearly indicated. Where no distribution is given it should be understood that the species is common throughout Tropical Africa.

Anonaceae.

Artabotrys nigericus, *Hutchinson*, sp. nov.; valde affinis *A. nitido*, Engl. (sp. afr. orient.), sed inflorescentiis et floribus minoribus differt.

Frutex 5–6·5 m. altus; rami flexuosi, lenticellis numerosis instructi, glabri. *Folia* elliptica vel oblongo-elliptica, breviter et obtuse acuminata, basi obtusa vel breviter cuneata, 8–12 cm. longa, 3–5 cm. lata, tenuiter coriacea, utrinque glabra et laxe reticulata, supra nitidula; costa utrinque verruculosa; nervi laterales utrinsecus circiter 8, a costa sub angulo 75° abeuntes, marginem versus furcati et ramosissimi, venis laxis utrinque conspicuis; petioli 4–5 mm. longi, parce pubescentes. *Inflorescentia* brevissima, uncinata, vix 1·5 cm. longa; pedicelli curvati, 4 mm. longi, appresse pubescentes; bracteae ovatae, 2·5 mm. longae, extra hirsutae. *Sepala* triangularia, subacuta, rigida, 3 mm. longa, basi 4 mm. lata, extra parce puberula. *Petala* subaequalia, e basi cucullata lineari-teretia, fere 2 cm. longa, medio 1·75 mm. crassa. *Stamina* 1·25 mm. longa, apice plana, rotundata, 1 mm. diametro. *Carpella* 1·5 mm. longa, glabra. *Fructus* non visus.

Northern Nigeria. Naraguta, 17 August, shrub 15–20 ft. on river banks, flowers yellow, scented, *H. V. Lely*, No. 541.

Menispermaceae.

Cissampelos mucronata, *Rich.*; F.T.A. i. 45; Holland, 52 (under *C. Pareira*); Diels, Monogr. Menisp. 300.

Naraguta, climbing 2–3 ft., male flowers green, No. 15.

Distrib.—Senegal to South Africa.

Papaveraceae.

Argemone mexicana, *Linn.*; F.T.A. i. 54; Holland, 53.

Mamu, 2500 ft., 11 May, "yellow poppy," 2 ft., No. 160.

Hausa name "Kaya Geiva" (Elephant's Thorn).

An introduced weed, common in the tropics and subtropics.

Cruciferae.

Lepidium sativum, *Linn.*; F.T.A. i. 69.

Baradau, 3000 ft., in fruit 3 May, 18 ins. high, flowers yellow, No. 87.

Capparidaceae.

Cleome monophylla, *Linn.*; F.T.A. i. 76.

Baradau, 3000 ft., 3 May, 6–12 ins., pale pink flower, No. 88.
Neill's Valley, 2 miles east of Gov. Station, Naraguta, 15 June, No. 273.

Gynandropsis pentaphylla, *DC.*; F.T.A. i. 82; Holland, 54.

Mamu, 2500 ft., 11 May, 2 ft. high, used as an ear medicine and the leaves for muja (sauce), No. 158.

Bixaceae.

Cochlospermum tinctorium, *Rich.*; F.T.A. 113; Holland, 57.

Naraguta, 3–4 ins., flowers bright yellow, on the ground, No. 4.

See notes in *Kew Bull.* 1921, No. 6, pp. 240, 245.

Polygalaceae.

Polygala Volkensii, Gürke in Engler, Pflanzenw. Ost-Afr. C. 234 (1895).

Naraguta, 20 June and 1 August, herb about 2 ft. 6 ins. high, slender raceme of green and mauve flowers, Nos. 275 and 472. Collected also by Dr. J. M. Dalziel (No. 60) in grassy meadows, Zungeru.

Distrib.—Hitherto only recorded from East Africa, from the Nyasa Highlands (Tanganyika Territory) south to the Mazoe district of Rhodesia (F. Eyles 609). The Nigerian plant seems to be identical.

Polygala micrantha, *G. & P.*; F.T.A. i. 131; Chodat Monogr. Polygalac. 217 (1891).

Plains between Hepham and Ropp, 4600 ft.; 4 ins. high, spikes of mauve flowers, No. 355.

Distrib.—Senegambia to the Chari Region.

Polygala arenaria, *Willd.*; F.T.A. i. 128; Chodat, Monogr. Polygalac. 337, t. xxvii. fig. 35–36.

Naraguta, 8 Aug., small herb amongst rocks, 3–4 ins. high, dorsal petal and wings salmon pink, keel purple, crested, No. 527.

Polygala Bäikiei, *Chodat,* Monogr. Polygalac. 334 (1891).

Naraguta, 5 Aug., amongst rocks, herb about 5 ft. high, with single raceme of mauve-pink flowers.
Hausa "Jina Jina," No. 487.

Apparently endemic to Northern Nigeria.

Polygala acicularis, *Oliv.*; F.T.A. i. 132; Chodat, Monogr. Polygalac. 368.

Plains between Hepham and Ropp, 4600 ft., 5 July; 2 ft. high, petals cream coloured with fine purple veins, keel blue or purple, No. 373.

Distrib.—West Africa from N. Nigeria to Angola, and in Uganda.

Hypericaceae.

Haronga paniculata, *Lodd. ex Steud.* Nom. ed. II. i. 722.

Arungana paniculata, Pers. Syn. Pl. ii. 91 (1807).

Haronga madagascariensis, Choisy Prodr. Monog. Hyper. 34 (1821); F.T.A. i. 160; Holland, 62.

Naraguta, 5 Aug., robust shrub 5–6 ft., on rocks on stream banks, flowers greenish white, orange coloured sap, Hausa "Alibiba rafi," No. 493.

Distrib.—One of the most widely spread of African shrubs, also in the Mascarene Islands.

Portulacaceae.

Portulaca oleracea, *Linn.*; F.T.A. i. 148; Holland, 61. Taura, 6 May; 6–12 ins., leaves fleshy, flowers yellow in clusters, No. 122.

Dipterocarpaceae.

Monotes caloneurus, *Gilg* in Engl. Bot. Jahrb. xxviii. 136 (1901).

Naraguta, on rocks 8 Aug.; flowers green, No. 517.

Distrib.—South Eastern Sudan and in Angola.

Malvaceae.

Sida linifolia, *Cav.*; F.T.A. i. 179.

Naraguta, 20 June, petals yellow with red basal blotch, 15 ins. high, No. 279.

There is evidently colour variation in the flowers, for Dalziel and Parsons describe them as white with purple centre.

Distrib.—Throughout West Africa to Angola and also in the West Indies and the north east coast of S. America.

Sida spinosa, *Linn.*; F.T.A. i. 180.

Lemme, 2600 ft., 1–2 ft., No. 140.

Sida cordifolia, *Linn.*; F.T.A. i. 181.

Panyam, 4500 ft., 17 July, flowers yellow, ½ in. in diameter, No. 437.

Urena lobata, *Linn.*; F.T.A. i. 189; Holland 68.

Ringim Mukr, 2500 ft., 22 May, flowers bright pink, on stream banks, 2–3 ft. high, No. 218.

Kosteletzkya Büttneri, *Gürke ex Buettn.* in Verh. Bot. Ver. Brand. xxxi. 92 (1889).

Panyam, 4500 ft., 11 July; 2–3 ft., white flowers with pink veins, 1¼ ins. in diam., No. 416.

Distrib.—Hitherto known only from Angola to the South Eastern Belgian Congo.

Hibiscus articulatus, *Hochst.*; F.T.A. i. 200.

Nabardo, 2300 ft., 20 May, flowers yellow changing to pink, petals twisting up closely after pollination, not seen open, No. 206.

Apparently a rather variable species with a woody rhizome; distribution rather scattered and mainly in East Africa, from the Eastern Sudan and Abyssinia to the Zambesi.

Sterculiaceae.

Melochia melissifolia, var. **bracteosa**, *K. Schum.* Monogr. Afr. Sterculiac. 43 (1900).

Plains between Hepham and Ropp, 4600 ft., 5 July; stems decumbent, 1–3 ft., purple, woody, leaves edged with red, and venation red below, No. 370.

Distrib.—Upper Guinea and Central Africa generally.

Waltheria americana, *Linn.*; K. Schum. Monogr. Afr. Stercul. 45 (1900); Holland, 95.

Bauchi, 2200 ft., 2 ft. high, flowers yellow, No. 171.

Naraguta, 4000 ft., 30 June, No. 339.

Tiliaceae.

Grewia mollis, *Juss.*; F.T.A., i. 248; Holland, 106.

Naratga, 3 ft. high, flowers yellow, No. 74.

Distrib.—From Sierra Leone across North Tropical Africa to the Eastern Sudan and Uganda.

Grewia bicolor, *Juss.*; F.T.A. i. 248 (under *G. salvifolia*, Heyne); Holland, 105.

Mamu, 2500 ft., 11 May, a large tree 40 ft. high on hill tops, flowers yellow. Hausa name "Markin Dutsi" (or the rock growing *Anogeissus*), No. 161.

Distrib.—From Senegal to the Niger, and in North East Trop. Africa and the Zambesi delta.

Triumfetta lepidota, *K. Schum.*; Sprague and Hutch. in Journ. Linn. Soc. Bot. xxxix. 245 (1909).

Nabardo, 2300 ft., 20 May, large strong, woody perennial plant up to 5 ft., flowers bright yellow, No. 217.

Distrib.—Across the savannah country from the Gold Coast to Niamniamland.

Triumfetta dubia, *De Wild.*; Sprague and Hutch. in Journ. Linn. Soc. Bot. xxxix. 259 (1909).

Naraguta, 23 June, 12–18 ins., small greenish brown hirsute flowers, No. 334; 17 Aug., No. 535.

Distrib.—From Togoland to Tanganyika Territory.

Triumfetta tomentosa, *Bojer*; Sprague and Hutch. in Journ. Linn. Soc. Bot. xxxix. 260 (1909).

Naraguta, 8 Aug., grass lands, herb 2–3 ft., branching tough woody stems, leaves velvety, flowers orange yellow, No. 511.

Distrib.—Tropical Africa from Nigeria southwards.

Corchorus olitorius, *Linn.*; F.T.A. i. 262; Holland, 114.

Mongu, 4300 ft., 10 July, 1 ft. high, No. 401.

Corchorus trilocularis, *Linn.*; F.T.A. i. 262.

Takwara, 3200 ft., 4 May, 1 ft. high, flowers yellow, No. 100.

Distrib.—Rare in Upper Guinea, but common in most other parts of Tropical Africa.

Zygophyllaceae.

Tribulus terrestris, *Linn.*; F.T.A. i. 283.

Takwara, 3200 ft., 4 May, trailing 1 ft. long, flowers yellow, No. 99.

Oxalidaceae.

Biophytum Apodiscias, *Edgew. & Hook. f.*; F.T.A. i. 297 (as *Oxalis sensitiva*, partly).

Naraguta, 20 June, corolla pale apricot, No. 277.

Oxalis corniculata, *Linn.*; F.T.A. i. 296.

Plains between Hepham and Ropp, 4600 ft., 5 July, decumbent, 4–6 ins., flowers yellow, No. 354.

Celastraceae.

Gymnosporia senegalensis, *Loes.*, forma **coriacea,** *Loes.* in Engl. Bot. Jahrb. xvii. 542 (1893), (sub *Celastrus senegalensis*, Lam.; F.T.A. i. 361).

Naraguta, 1 ft. high, flowers greenish white, No. 68.

Vitaceae.

Ampelocissus bombycina, *Planch.*; Gilg & Brandt, Vitac. Afric. in Engl. Bot. Jahrb. xlvi. 431 (1912).

Vitis bombycina, Baker in Fl. Trop. Afr. i. 399.

Rinjim Mukr, 2500 ft., 22 May, climber, umbel of red flowers, No. 223.

Distrib.—Also in Togoland and the Gold Coast.

Cissus corylifolia, *Planch.*; Gilg & Brandt, Vitac. Afric. in Engl. Bot. Jahrb. xlvi. 473 (1912).

Nabardo, 2300 ft., 20 May, 2–2½ ft., umbel of reddish flowers, leaf attaining nearly 1 ft. across, No. 207; found also at Abinsi, 30 April, 1912, by *Dr. J. M. Dalziel* (No. 673).

Distrib.—Originally collected by Barter in Nupe, and evidently confined to Northern Nigeria.

Cissus rufescens, *G. & P.*; Gilg & Brandt, Vitac. Afr. in Engl. Bot. Jahrb. xlvi. 473 (1912).

Pankshin, 5100 ft., 14 July; climbing and creeping, 10 ft., flowers small, red. No. 434.

Distrib.—Senegambia to the Cameroons and Lake Chad region.

Cissus Lelyi, *Hutchinson*, sp. nov.; affinis *C. Schweinfurthii*, Planch., sed petiolis longioribus foliorum marginibus et alabastris haud glandulosis differt.

Herba scandens 2 m. alta vel ultra; caulis circiter 3·5 mm. crassus, dense strigilloso-tomentosus et pilis rigidis apice glandulosis parce indutus; internodii 5–5·5 cm. longi. *Cirrhi* oppositifolii, ad 10 cm. longi, superne contorti, albido-pubescentes. *Folia* digitatim 5–foliolata, breviter petiolata, foliolis oblanceolatis acutis basi attenuatis 5–9 cm. longis 1–2 cm. latis chartaceis acute dentatis nervis et venis utrinque pubescentibus; petioli 1–1·5 cm. longi, pubescentes; petioluli 3–5 mm. longi; stipulae lineari-oblongae, acute acuminatae, usque ad 1·5 cm. longae, 3 mm. latae, extra strigilloso-pubescentes, intra glabrae et striatae. *Inflorescentia* terminalis, cymosa, circiter 6 cm. expansa; pedunculus ad 6·5 cm. longus, pubescens et parce glanduloso-pilosus; pedicelli 2–2·5 mm. longi, dense pubescentes. *Calyx* subnullus, extra pubescens. *Corolla* urceolata, medio contracta apice truncata, 2·5–3 mm. longa, 1·75 mm. diametro, appresse pubescens. *Stamina* plerumque 4, erecta, inter lobos disci inserta; filamenta 1·75 mm. longa; antherae rotundatae, 0·65 mm. longae. *Ovarium* ovoideum, glabrum; stylus 1 mm. longus.

Northern Nigeria. Top of Zaranda Mountain, 5800 ft., climbing 6 ft. or more, flowers greenish white, 18 May 1921, *H. V. Lely* No. 194.

Cissus crotalarioides, *Planch.*; Gilg & Brandt, Vitac. Afr. in Engl. Bot. Jahrb. xlvi. 498 (1912).

Naraguta, 3 ft. high, No. 72.

Nabardo, 2300 ft., 20 May, 2–3 ft. high, umbel of greenish flowers, No. 210.

Distrib.—Also in Jurland, and Nyasaland.

Cissus adenocaulis, *Steud.*; Gilg & Brandt, Vitac. Afr. in Engl. Bot. Jahrb. xlvi. 516 (1912).

Tilde Filani, 3300 ft., 24 May, climbing 10 ft., umbel of red flowers, No. 224.

Distrib.—Very widely spread in Tropical Africa.

Cissus rubiginosa, *Welw.*; Gilg & Brandt, Vitac. Afr. in Engl. Bot. Jahrb. xlvi. 475 (1912).

Mongu, 4300 ft., 8 July; 2 ft. high, flowers small, white, No. 388.

Distrib.—N. Nigeria, Angola, and the Northern Lake Region of East Africa.

Sapindaceae.

Cardiospermum Halicacabum, *Linn.*; F.T.A. i. 417.

Panyam, 4500 ft., 17 July; climber 6 ft. high, small white flowers, fruit a three-lobed bladder which "pops," No. 436.

Paullinia pinnata, *Linn.*; F.T.A. i. 419.

Zelau, 3200 ft., climbing 5–8 ft., flowers white, No. 111.

Naraguta, 23 June, 2–3 ft., No. 330.

Common throughout Tropical Africa, the Mascarenes and in Tropical America.

Schmidelia africana, *DC.*; F.T.A. i. 421.

Mongu, 4300 ft., 8 July: woody shrub 5–6 ft. high, ♂ flowers green, No. 389.

Distrib.—West Africa generally.

Schmidelia affinis, *G. & P.*; F.T.A. i. 422.

Vodni, 4600 ft., 13 July, shrub 5 ft., ♂ flowers white, sweet scented, No. 428.

Schmidelia magica, *Baker* in Fl. Trop. Afr. i. 423.

Zaranda Filani, stream sides, 19 May, shrub 4 ft., spikes of small, white, sweet scented flowers, No. 187.

Recorded from "Guinea," from Oloke Meji (*Foster* 96), and from Nupe (*Barter* 1648).

Anacardiaceae.

Anaphrenium pulcherrimum, *Schweinf.*; Engl. Monogr. Anacard. 356. *Rhus pulcherrima*, Oliv. Fl. Trop. Afr. i. 436.

Naraguta, 1–3 ft., flowers white or pale yellow, fruits red, Nos. 25, 71.

Plains between Hepham and Ropp, 4600 ft., 5 July, flowers pale purple, No. 351.

Occurs also in East and South East Tropical Africa.

Connaraceae.

Rourea gudguana, *Gilg* in Engl. Bot. Jahrb. xiv. 323.

Naraguta, shrub 10–12 ft., flowers white, No. 73.

Distributed from the hinterland of Sierra Leone to Dar Fertit in the Eastern Sudan.

Leguminosae.

Subfamily **Papilionaceae.**

Crotalaria graminicola, *Taub.* ex *Baker f.* in Journ. Linn. Soc. Bot. xlii. 291 (1914).

Naraguta, 4000 ft.; 6–12 ins. high, flowers orange-yellow, Nos. 53, 238.

Distrib.—Senegambia to the Cameroons.

Crotalaria lachnosema, *Stapf* in Kew Bull. 1910, 329; Baker f. in Journ. Linn. Soc. Bot. xlii. 323.

Naraguta, large bushy plant 3 ft. high, flowers yellow with orange veins, No. 51.

Ropp, 4600 ft., 19 July, No. 455.

Distrib.—Liberia to the Cameroons.

Crotalaria crepitans, *Hutchinson*, sp. nov.; affinis *C. rectae*, Steud., sed bracteolis medio pedicellorum insertis, calyce extra breviter sericeo-pubescente differt.

Herba erecta 1 m. alta; caulis robustus, pluricostatus, circiter 6 mm. crassus, minute et crebre pubescens, sicco pallide cinereus, internodiis 2–3 cm. longis. *Folia* trifoliolata; petioli 2–2·5 cm. longi, parce pubescentes; stipulae lineari-subulatae, acutae, circiter 6 mm. longae, appresse pubescentes; foliola obovato-oblanceolata, apice rotundata et conspicue hirsuto-mucronata, basi cuneata, 4–6 cm. longa, 1·5–2·5 cm. lata, supra viridia et dense fungoso-maculata, infra pallida et breviter albido- pubescentia; nervi laterales utrinsecus 8–9 infra crassi et prominentes marginem versus conjuncti. *Racemi* usque ad 25 cm. longi; pedicelli 5–7 mm. longi, albo-pubescentes; bracteae lineari-subulatae, acutissimae, 6–8 mm. longae, 2 mm. latae, extra pubescentes; bracteolae 2 medio pedicellorum insertae, subulatae, 3 mm. longae. *Flores* flavi, brunneo-purpureo striati. *Calyx* 1·3 cm. longus; lobi lanceolato-deltoidei, acuti, circiter 7 mm. longi, basi 4 mm. lati, parce pubescentes. *Vexillum* glabrum, oblongo-obovatum, 1·5 cm. longum, 8 mm. latum, usque 4 mm. longum. *Alae* et carina apice firme conniventes, circiter 1·5 cm. longae. *Ovarium* glabrum, nigrum. *Fructus* immaturus 3 cm. longus, niger.

Northern Nigeria. Plains between Hepham and Ropp, 4600 ft., 5 July, 3 ft. high, flowers yellow, standard petal striped brown-purple at the base, wings also at the base and on the back edges, pods rattle when ripe, *H. V. Lely* No. 378.

The upper surface of the leaves of this species are everywhere closely infested with the fungus *Parodiella perisporioides*, kindly identified by Miss E. M. Wakefield. It gives the leaves a densely black mottled appearance.

Crotalaria naragutensis, *Hutchinson*, sp. nov.; affinis *C. Pechuelianae*, Schinz, sed calyce longiore lobis multo angustioribus, carina longe acuminata differt.

Frutex robustus, ramosus, 1·5–2 m. altus; rami costati, dense et molliter cinereo-tomentelli. *Folia* trifoliolata, laxe disposita; petioli 2·5–3 cm. longi, tomentelli, stipulae caducae, subulatae, 4 mm. longae; foliola obovata, late emarginata et mucronulata, basi cuneata, terminalia lateralibus paullo majora, 2–4·5 cm. longa, 1·5–2·5 cm. lata, supra glabra, infra minute appresse pubescentia; nervi laterales utrinsecus 6–8, a costa sub angulo 45° abeuntes, marginem versus evanidi, venis vix evolutis; petioluli circiter 1·5 mm. longi. *Racemi* terminales,

longe pedunculati, usque ad 20 cm. longi; rhachis conspicue angularis, cinereo-tomentella; pedicelli 3–4 mm. longi; bracteae caducae, filiformes, 7 mm. longae. *Alabastra* curvato-rostrata, sericeo-tomentosa. *Calyx* campanulatus, appresse tomentosus; tubus 3·5 mm. longus; lobi subulato-lanceolati, acuti, ad 6 mm. longi. *Petala* flava, glabra; carina 1·3 cm. longa, fere semilunaria, rostrata; alae oblongae, vix 1 cm. longae. *Ovarium* supra dense hirsutum. *Fructus* ignotus.

Northern Nigeria. Naraguta, amongst rocks near water, 5 Aug., 1921, woody robust branching plant about 4–6 ft. high, Hausa "Bekkin Bi-rana," *H. V. Lely* No. 490.

Crotalaria cylindrocarpa, *DC.*; F.T.A. ii. 40; Baker f. in Journ. Linn. Soc. Bot. xlii. 414 (1914).

Naraguta, grasslands, 2 Aug.; herb with woody stems about 1 ft. high, flowers yellow also in fruit, No. 480.

Distrib.—Senegambia and Northern Nigeria.

Indigofera Dalzielii, *Hutchinson* in Kew Bull. 1921, 246.

Bichikki, 2200 ft., 19 May, No. 188.

Distrib.—An endemic Northern Nigerian species.

Indigofera dendroides, *Jacq.*; F.T.A. ii. 100; E. G. Baker in Journ. Bot. 1903, 245.

Naraguta, 4000 ft., 30 June, 1 ft. high, flowers red-brown, No. 337.

Distrib.—Senegambia to East Africa and in Angola.

Indigofera stenophylla, *G. & P.*; F.T.A. ii. 83; E. G. Baker in Journ. Bot. 1903, 260.

Panyam, 4500 ft., 11 July, racemes of bright pink flowers, No. 408.

Distrib.—North Tropical Africa.

Indigofera hirsuta, *Linn.*; F.T.A. ii. 88; E. G. Baker in Journ. Bot. 1903, 265; Holland, 191.

Naraguta, 8 Aug., herb. 1–2 ft. high, amongst rocks, flowers pink, sepals covered with soft black hairs, inflorescence spicate, appearing to be smoky coloured, No. 510.

Indigofera macrophylla, *Schumach.*; F.T.A. ii. 100; E. G. Baker in Journ. Bot. 1903, 330.

Neill's Valley, 2 miles east of Naraguta Gov. Station, 15 June, No. 261.

Distrib.—Senegambia to S. Nigeria and in Angola.

Tephrosia densiflora, *Hook. f.*; F.T.A. ii. 114.

Naraguta, on stream banks amongst rocks, 5 Aug.; robust shrubby plant about 6 ft., large mauve flowers appearing one at a time, back of standard petal grey-brown, No. 488.

First collected by Vogel near Mt. Patti, and subsequently by Barter at Jebba, but not gathered since then until its rediscovery by Mr. Lely. Evidently a species endemic to the Niger Basin.

Tephrosia Ansellii, *Hook. f.*; F.T.A. ii. 115.

Neill's Valley, 2 miles East of Government Station, Naraguta; stems 2–3 ft. high, strong and wiry, branched, flowers mauve, No. 270.

Naraguta, 8 Aug., herb 3 ft. high, amongst rocks, flowers deep crimson, No. 529.

Distrib.—Togoland to the Belgian Congo.

Tephrosia radicans, *Welw.*; F.T.A. ii. 121.

Vodni, 4600 ft., 13 July, procumbent, flowers pink, No. 422.

Distrib.—Hitherto known only from Angola and North West Rhodesia.

Sesbania pachycarpa, *DC.*; Phillips & Hutch. in Bothalia, 1. 50.

Naraguta, 8 Aug., robust plant 5–6 ft. high, on rocks in open country, leaflets closing up at night, flowers yellow, the back of the standard and the keel thickly mottled with black, No. 534.

Distrib.—North Tropical Africa generally, and in Angola.

Smithia speciosa, *Hutchinson*, sp. nov.; affinis *S. strigosae*, Benth., sed robustior, floribus multo majoribus, bracteolis latioribus et vix cuspidato-acuminatis, petalis latioribus differt.

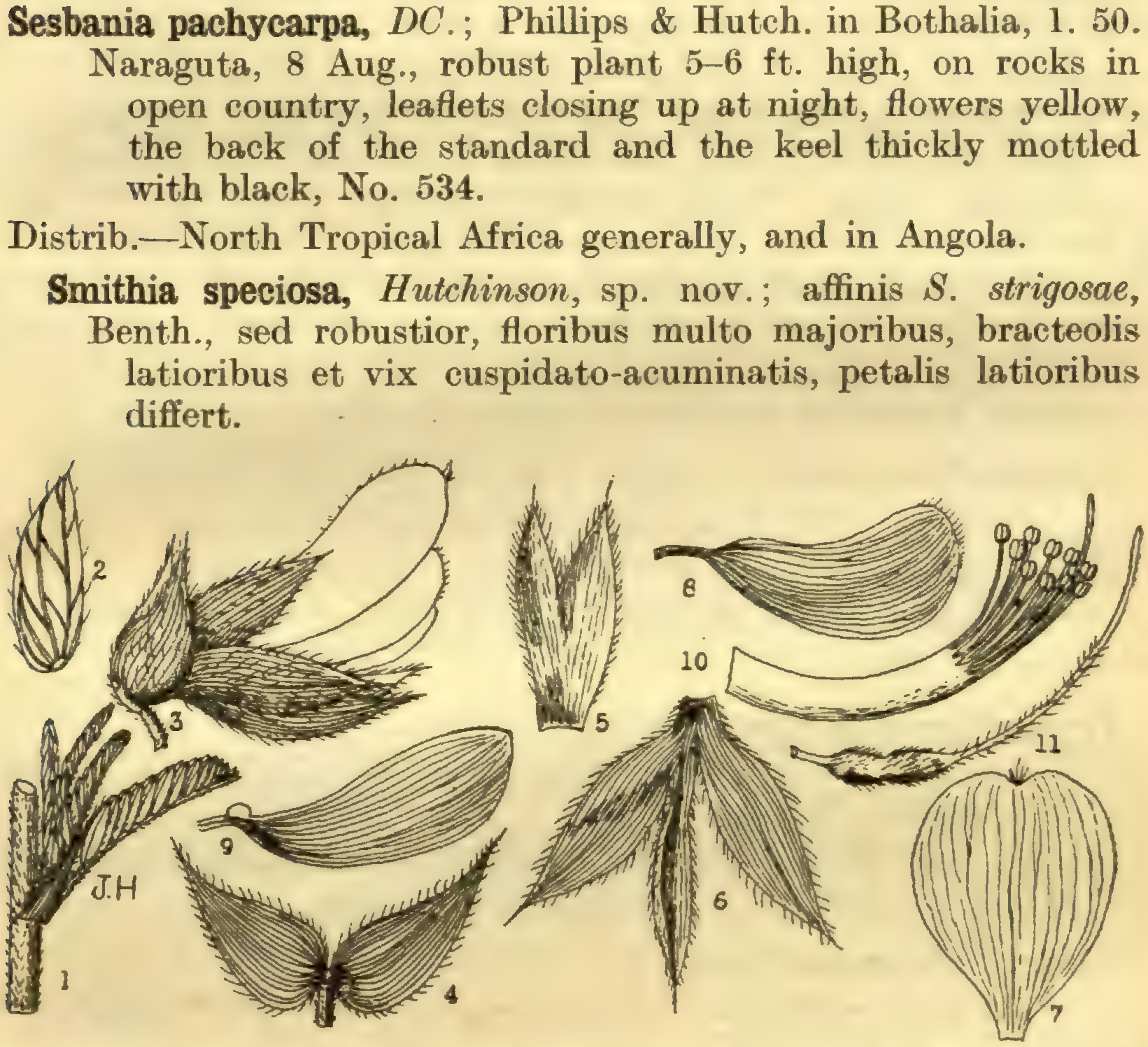

Fig. 1. *Smithia speciosa*, Hutchinson. 1, part of leafy shoot; 2 leaflet; 3, flower; 4, pair of bracteoles; 5, upper lip of calyx; 6, lower lip of same; 7, standard; 8, wing petal; 9, keel petal; 10, stamens; 11, pistil.

Frutex robustus, 1·3–1·75 m. altus; caules numerosi, erecti, ramosi; ramuli teretes, pilis gracilibus mollibus basi pustulatis tomentosi, inferne stipulis persistentibus ornati. *Folia* fasciculata, pinnata, usque ad 1·5 cm. longa, breviter petiolata; stipulae basi petiolo adnatae, oblique lanceolatae, acutissime acuminatae, circiter 1 cm. longae, basi circiter 3·5 mm. latae, conspicue nervosae, ciliatae; foliola oblongo-elliptica, subacuta, basi rotundata vel obtusa, 4–5 mm. longa, 1·5–2 mm. lata, coriacea, parce ciliata, pellucide punctata, basi circiter 5-nervia.

Racemi laterales, densi, circiter 2·5 cm. longi, conspicue bracteati; bracteae ovato-orbiculares, rigide cuspidato-acuminatae, circiter 8 mm. longae, et 4 mm. latae, nervosae, ciliatae; bracteae oblique ovatae, acuminatae, 7 mm. longae, 4 mm. latae; pedicelli 3 mm. longi, pubescentes. *Calyx* bilabiatus, ciliatus, labio superiore ad medium bilobato 1 cm. longo, 5 mm. lato, labio inferiore profunde trilobato lobis lateralibus planis intermedio cymbiforme 1·3 cm. longo ciliato-apiculato. *Petala* coerulea; vexillum obovatum, late emarginatum, apice ciliato-mucronatum, 1·4 cm. longum, 1 cm. latum; alae oblique obovato-oblongae, superne parve ciliatae, 1·2 cm. longae et 4 mm. latae; carina 1·4 cm. longa, apice minute denticulata. *Ovarium* 2-ovulatum, sericeo-tomentosum, stylo gracile inferne laxe piloso. *Fructus* ignotus.

NORTHERN NIGERIA. Naraguta, in open grass and amongst rocks, 2 Aug., 1921, perennial about 4–5 ft. high, branching from numerous stems, flowers bright prussian blue, *H. V. Lely* No. 478.

This is the first species of *Smithia* recorded from Nigeria, and it finds its nearest relative in the Mascarene and South East Tropical African (Nyasaland and Rhodesia) *Smithia strigosa*, Benth. Details of the floral structure are shown in figure 1.

Stylosanthes erecta, *P. Beauv.*; F.T.A. ii. 156.
Bichikki, 2000 ft., 17 May, ½–2 ft., No. 178.

Zornia diphylla, *Pers.*; F.T.A. ii. 158; Holland, 206.
Nabardo, 2300 ft., 20 May, 6–12 ins., flowers greenish, No. 205.

Desmodium dimorphum, *Welw.*; F.T.A. ii. 161.
Naraguta, amongst rocks, 8 Aug.; herb 2 ft. high, flowers mauve, No. 513.
Distrib.—From Angola across the Zambesi Basin into Usambara; this is the first record from Upper Guinea.

Desmodium gangeticum, *DC.*, F.T.A. ii. 161.
Baradau, 3000 ft., 3 May, 1–1½ ft. high, flowers pink, and in fruit, No. 85.

Desmodium lasiocarpum, *DC.*; F.T.A. ii. 162.
Naraguta, in grasslands, 20 Aug.; woody plant 3 ft. high, with pale flowers, No. 546.

Desmodium ascendens, *DC.*; F.T.A. ii. 162.
Naraguta, 18 ins., flowers red, No. 18.
Lemme, 2600 ft., 7 May, No. 147.
Distrib.—West Africa generally and in East Tropical Africa; occurs also in the West Indies and Eastern Brazil.

Desmodium mauritianum, *DC.*; F.T.A. ii. 164.
Plains between Hepham and Ropp, 4600 ft., 5 July, 9 ins. high, flowers dark red, No. 359.

Alysicarpus Zeyheri, *Harv.*; F.T.A. ii. 170.

Lemme, 2600 ft., 7 May, flowers brownish, fruits articulated, not wrinkled, No. 135.

Mongu, 4300 ft., 8 July, flowers red, and fruits, No. 394.

Distributed East and Southward to the Transvaal.

There are several species of *Alysicarpus* in Northern Nigeria, and as they are mainly determined by fruit characters it is necessary that fruits should be collected where possible. *A. vaginalis*, DC., with a very lax inflorescence and turgid, slightly moniliform fruit, often black when quite ripe, is according to Dalziel, called "Gadiggi," and is a food for horses, sheep, goats, etc. It is common in pastures. *A. Zeyheri*, Harv., first recorded here from Upper Guinea, has rather flattened smooth (not wrinkled) pods arranged on an elongated axis. In the absence of fruits it is difficult to distinguish from a third species, occurring in Nigeria, *A. rugosus*, DC., with very dry, chaffy bracts, rather densely arranged and strongly and transversely wrinkled fruits, also described by Mr. Lamb as a valuable fodder and an ubiquitous weed of arable land in Northern Nigeria. It is evidently not distinguished by the vernacular from *A. vaginalis*. The species of this genus need study in the field, especially in regard to the form and variation of the fruit.

Canavalia africana, *Dunn*, mss.

Mongu, 4300 ft., 8 July; climbing 15 ft., flowers pink, pods 12–18 ins., used for rattles, Hausa "Borran Kashi," No. 387.

This is an undescribed species which will be dealt with by Mr. S. T. Dunn in a forthcoming revision of the genus *Canavalia*.

Vigna longissima, *Hutchinson*, sp. nov.; species foliis et pedicellis longissimis valde distincta. (*See* p. 368.)

Herba gracilis, 15–20 cm. alta, basi ramosa; caules graciles, primum prostrati, demum ascendentes, laxe pilosi, sulcati. *Folia* pauca, longissime petiolata, trifoliolata; petioli usque ad 14 cm. longi, sulcati, glabri; stipulae ovato-lanceolatae, acute acuminatae, circiter 8 mm. longae et 2·5 mm. latae, prominenter nervosae, parce ciliatae; foliola elongato-linearia, acuta, 6–18 cm. longa, 2–8 mm. lata, trinervia, fere glabra, utrinque prominenter reticulata, nervis infra prominentibus. *Flores* solitarii, pallide coerulei; pedicelli longissimi, usque ad 15 cm., superne parce pubescentes. *Calyx* oblongo-campanulatus, 8 mm. longus, extra prominenter nervosus et parce pilosus; tubus 3·5 mm. longus, lobis posticis supra medium connatis, anticis e basi triangulare linearibus circiter 5 mm. longis. *Vexillum* latissime rotundatum, late emarginatum et mucronatum, 1·8 cm. longum, 2·5 cm. latum, appendicibus binis hamatis. *Carinae* petala valde incurva, superne firme connata, *Ovarium* villosum; stylus incurvatus, superne unilatere villosus. *Fructus* non visus.

Northern Nigeria. Plains between Hepham and Ropp, 4600 ft., 5 July, 1921, *H. V. Lely* No. 360.

Dolichos biflorus, *Linn.*; F.T.A. ii. 210; Holland, 234.

Plains between Hepham and Ropp, 4600 ft., 5 July; procumbent, 2 ft. long, flowers pale yellow in pairs, No. 352.

Naraguta, 29 July; trailing procumbent plant, 3–4 ft. long, many cream coloured flowers; standard petal with purple raised lines at the base, No. 470.

Dolichos Lelyi, *Hutchinson* in *Kew Bull.* 1921, 247.

Naraguta, in clumps, No. 44. Nabardo, 2300 ft., 20 May, Nos. 208, 215. (*See* p. 369.)

Adenodolichos macrothyrsus, *Harms* in Engl. Bot. Jahrb. xxxiii. 180.

Mongu, 4300 ft., 8 July, main stem single, 3–10 ft., standard greenish, wings pink, keel white, No. 398.

Known only from Northern Nigeria and Jur and Bongoland in the South-eastern Sudan.

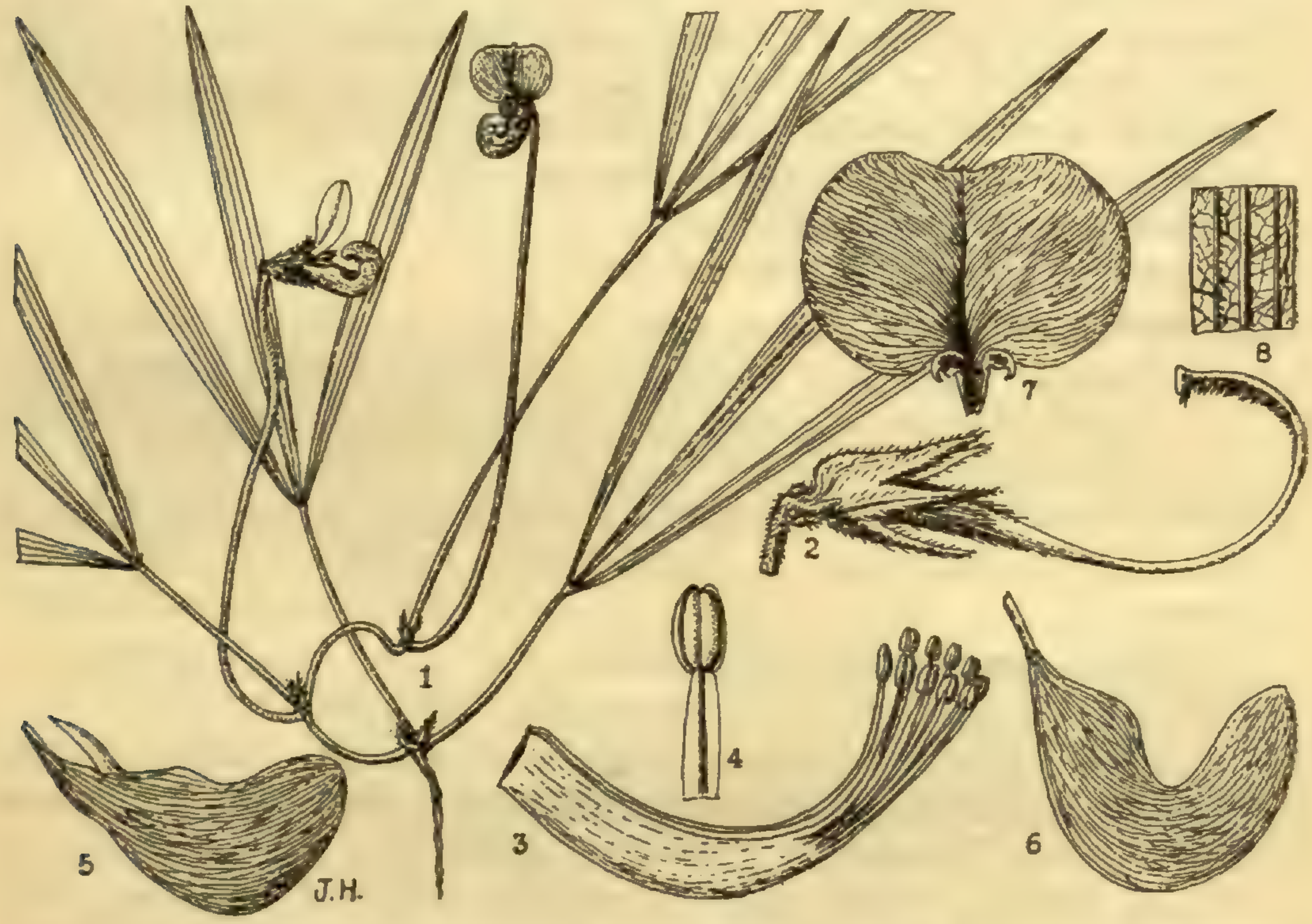

Fig. 2. *Vigna longissima*, Hutchinson. 1, whole plant, reduced; 2, calyx and pistil; 3, stamens; 4, anther; 5, wing petal; 6, keel petal; 7, standard; 8, portion of leaf showing lower surface. (*See* p. 367.)

Sphenostylis Schweinfurthii, *Harms* in Engl. Bot. Jahrb. xxvi. 309.

Ropp, 4600 ft., 19 July, 4 ft. high, stems woody and branching, flowers greenish yellow, No. 454.

Distrib.—From Northern Nigeria through the Chari region to Abyssinia.

Eriosema holophyllum, *Bak. f.* in Journ. Bot. 1895, 99.

Naraguta, 4000 ft., 30 May, 18 ins. high, loose short spike of white flowers, No. 240.

Previously known only by a fruiting specimen collected by Schweinfurth at Gumba, Niamniamland, in the South Eastern

Sudan. The two plants are identical. I give here a description of the flowers which have been collected for the first time by Mr. Lely :—

Racemi axillares et terminales, simplices vel leviter ramosi, usque ad 11 cm. longi; pedunculus 8–9 cm. longus, erectus, dense appresse pilosi; pedicelli 3–4 mm. longi, pubescentes; bracteae lineari-filiformes, 5 mm. longae, molliter pilosae; bracteolae geminatae, lineares, calycis tubo dimidio breviores. *Calycis* tubus anguste campanulatus, 2·5 mm. longus, pilosus, lobis duobus posticis subconnatis triangularibus, tribus anticis lanceolatis acutis circiter 2·5 mm. longis piloso-ciliatis. *Corolla* calyce leviter longior, alba; vexillum late oblongum, breviter unguiculatum, circiter 6 mm. longum et 3 mm. latum, aliis et carina leviter breviores. *Stamina* inclusa, 4 mm. longa. *Ovarium* fusiforme, 2·5 mm. longum, stylo breve curvato, stigmate capitato parvo.

Fig. 3. *Dolichos Lelyi*, Hutchinson. 1, flowering and fruiting shoot; 2, calyx; 3, vexillum; 4, pistil; 5, seed. (*See* p. 368.)

Eriosema cajanoides, *Hook. f.*; F.T.A. ii. 227; Baker f. in Journ. Bot. 1895, 144.

Nabardo, 2300 ft., 20 May; woody perennial, stem 1 inch thick, 6 ft. high, flowers bright yellow, No. 212.

Naraguta, 3 ft., No. 78.

Eriosema sparsiflorum, *Baker f.* in Journ. Bot. 1895, 144.
Naraguta, 4000 ft., 18 ins. high, flowers orange-red, No. 19; 30 June, No. 336.
Previously known only by the type specimen collected by Schweinfurth in Djurland, in the South Eastern Sudan.

Eriosema griseum, *Baker*; F.T.A., ii. 228; Baker f. in Journ. Bot. 1895, 227.
Naraguta, 7 May, 9 ins. high, flowers yellow, erect, No. 8.
Distrib.—Also in Angola and Bongoland (S.E. Sudan).

Eriosema glomeratum, *Hook. f.*; F.T.A. ii. 228; Baker f. in Journ. Bot. 1895, 228.
Mongu, 4300 ft., 8 July; 12 ins. high, heads of yellow and red flowers, No. 393.
Distrib.—Widely spread in North Tropical Africa.

Eriosema cordifolium, *Hochst.*; F.T.A. ii. 224; Baker f. in Journ. Bot. 1895, 230.
Naraguta, in grass country, 2 Aug.; herb about 9 ins. high, with heads of yellow flowers, petals with brown veins, No. 482.
This is the first record for this plant from anywhere outside Abyssinia, nearly 2,000 miles away, and it is a striking instance of the close affinity between the high level floras of East and West Africa.

Swartzia madagascariensis, *Desv.*; F.T.A. ii. 257; Holland, 248.
Fiskin Mata, 3000 ft., 23 Apr.; tree 15–20 ft., single petal white, No. 104.
Distrib.—A widely spread African tree, also in the Mascarenes.

Subfamily II. **Caesalpiniaceae.**

Cassia goratensis, *Fresen.*; F.T.A. ii. 273.
Vodni, 4600 ft., 13 July; woody, 2–6 ft. high, flowers yellow, No. 424.

Cassia Tora, *Linn.*; F.T.A. ii. 275; Holland, 260.
Panyam, 4500 ft., 11 July, 2–4 ft. high, No. 417.

Cassia obovata, *Collad*; F.T.A. ii. 277; Holland, 258.
Bichikki, 2200 ft., 17 May, flowers and fruit, No. 174.

Cassia mimosoides, *Linn.*; F.T.A. ii. 280; Holland, 258—*sensu lato*.
Naraguta, 17 Aug.; stout plant up to 6 ft., the leaflets closing up after sunset, flowers yellow, No. 538.
Distrib.—A common tropical weed, but probably represented in some regions by more than one distinct species.

Subfamily III. **Mimosaceae.**

Mimosa asperata, *Linn.*; F.T.A. ii. 335; Holland, 287.
Lemme, 2600 ft., large thorny shrub 12–15 ft. high, common on river banks, round clusters of mauve flowers, pods green and brown, hairy, No. 141.

Saxifragaceae.

Vahlia oldenlandioides, *Roxb.*; F.T.A. ii. 384.
Takwara, 3200 ft., 4 May; 4–6 ins. high, minute pale pink flowers, No. 106.

Droseraceae.

Drosera indica, *Linn.*; F.T.A. ii. 402.
Naraguta, 8 Aug.; plants 1–2 ins. high with small pink flowers, leaves fly-catching, No. 531.

Combretaceae.

Combretum herbaceum, *Don*; F.T.A. ii. 433; Engl. Monogr. Afr. Combret. 67; Hutch. in Kew Bull. 1921, 248.
Naraguta, 1–2 ft. high, flowers orange, fruits bright red, winged, No. 9.
Distrib.—Savannah region from Sierra Leone to the Eastern Chari.

Myrtaceae.

Eugenia owariensis, *Beauv.*; F.T.A. ii. 438; Holland, 320.
Naraguta, shrub 12 ft. high, flowers white, No. 82.

Melastomaceae.

Osbeckia postpluvialis, *Gilg*, Monogr. Afr. Melastomac. 6.
Ropp, 4600 ft., 19 July; 12 ins. high, flowers mauve, No. 447.
Known only from Northern Nigeria and Djurland in the Eastern Sudan, the latter being the type locality.

Dissotis Irvingiana, *Hook.*; F.T.A. ii. 453; Gilg, Monogr. Afr. Melastomac. 20; Holland, 321.
Naraguta, 23 June; 2 ft. 6 ins. high, whole plant closely covered with red hairs, flowers purple, No. 333.
Distrib.—Gold Coast to Northern Nigeria.

Dissotis graminicola, *Hutchinson*, sp. nov.; affinis *D. Perkinsiae*, Gilg, sed ex descriptione caule terete, foliis basi distincte cordatis supra dense setuloso-tomentosis, floribus paucis speciosis ovario‘apice pilis setosis concretis coronata differt. (*See* p. 372.)

Herba circiter 4·5 dm. alta, basi lignosa; caulis dense foliatus, teres, breviter tomentosus, basin versus circiter 6 mm. diametro, internodiis 2–2·5 cm. longis. *Folia* ovata, subacuta, basi cordata, 4–8 cm. longa, 2–4 cm. lata, coriacea, integra, supra dense setuloso-tomentosa, infra molliter tomentella, basi circiter 9-nervia, nervis ascendentibus subparallelis supra leviter impressis, infra prominentibus, nervis tertiariis transversis crebris prominulis; petioli 1 cm. longi, terètes, tomentosi. *Flores* speciosi, terminales, conferti, purpureo-coerulei. *Alabastra* anguste oblongo-ovoideum, circiter 2 cm. longum, ubique dense setosum. *Calycis tubus* ellipsoideo-campanulatus, circiter 1·3 cm.

longus et diametro, setis fasciculatis stipitatis dense indutus, lobi 5, oblique oblongi, apice pilis longis fasciculatis ornati, circiter 1 cm. longi, extra molliter appresse hirsuti. *Petala* 5, late obovata, intra basin breviter unguiculatam parce pilosa, cetera glabra, 3–3·5 cm. longa et 2·5 cm. lata. *Stamina* 10, valde inaequalia, 3 cm. et 4·5 cm. longa; antherae circiter 1·5 cm. longae, marginibus undulatis. *Ovarium* ovoideo-globosum, 5 mm. longum, densissime villosum, apice pilis setosis inferne concretis circiter 4 mm. longis coronatum; stylus 3 cm. longus, glaber, apice truncatus.

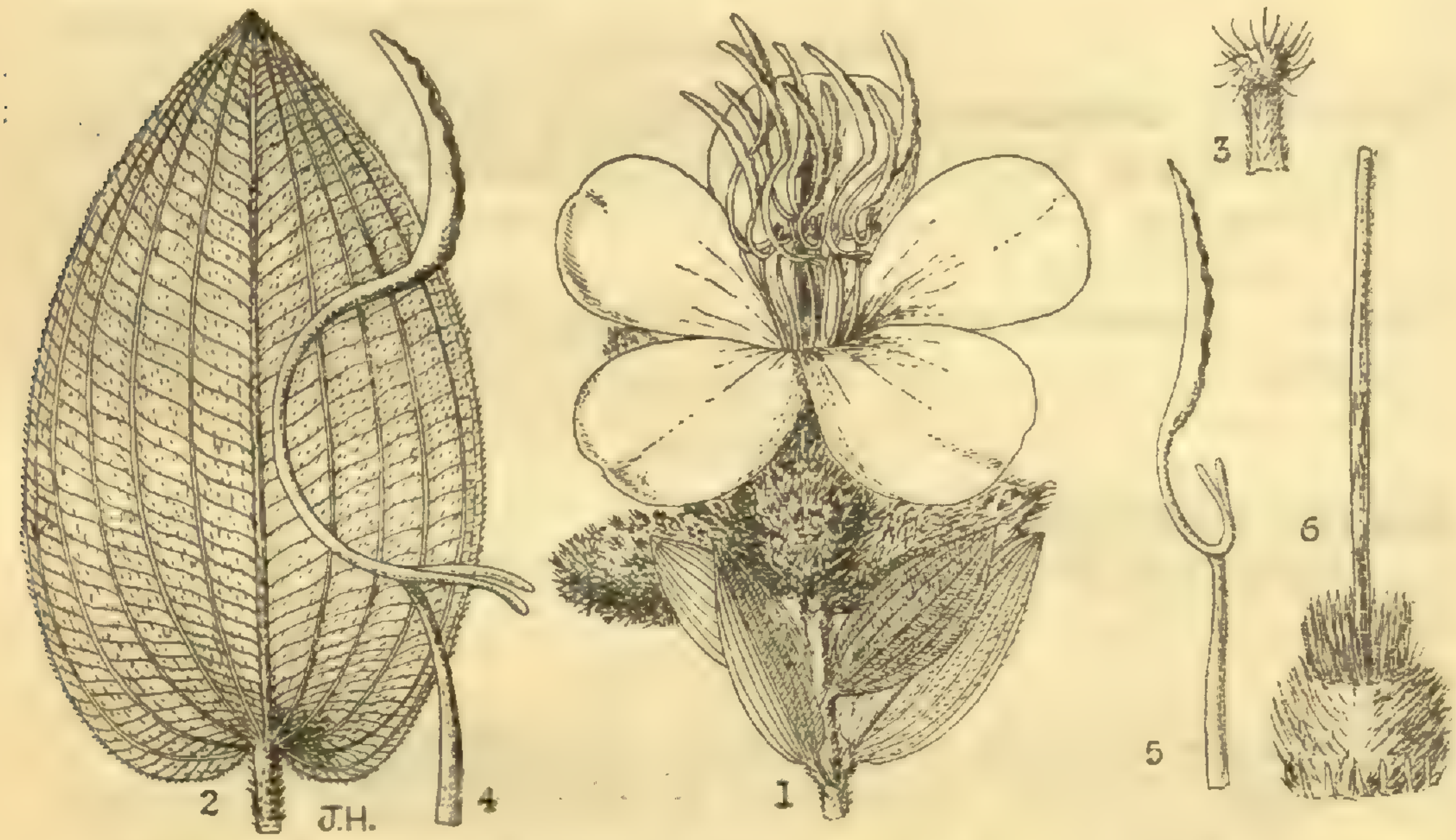

Fig. 4. *Dissotis graminicola*, Hutchinson. 1, top of flowering shoot × ½ 2, leaf showing under surface × ½; 3, appendage of calyx; 4, long, 5, short stamen; 6, pistil; 3-6 enlarged. (*See* p. 371.)

NORTHERN NIGERIA. Naraguta, in wet grass lands, 20 Aug., 1921, woody herb about 18 ins. high, flowers bluish-purple, *H. V. Lely* No. 543.

A very handsome and distinct species of *Dissotis* with flowers 6–7 cm. in diameter.

Dissotis cinerascens, *Hutchinson*, sp. nov., foliis oblongo-lanceolatis utrinque glabris parce ciliolatis, floribus terminalibus solitariis calycis tubo glabro distincta.

Herba cinerea, 4·5 dm. alta; caules parce ramosi, erecti, glabri, internodiis 5–7 cm. longi. *Folia* opposita, sessilia, oblongo-lanceolata vel lineari-oblonga, obtusa vel subacuta, basi lata et subamplexicaulia, 3–8 cm. longa, 0·6–1·3 cm. lata, parce setuloso-ciliata, supra opaca, infra cinerea, glabra, obscure trinervia. *Flores* solitarii, terminales, 4–5-meri (fide Lely); pedicelli 1 cm. longi, superne incrassati, glabri. *Calycis tubus* campanulatus, 1 cm. longus, striatus, glaber; segmenta lineari-lanceolata, acuta, 1·5 cm. longa, 3·5 mm. lata, minute et parce ciliolata, extra glabra, superne roseo suffusa. *Petala* late obovata, circiter 2·5 cm. longa et fere 2 cm. lata, glabra. *Stamina* 10, exserta, antheris 5 flavis basi breviter gibbosis, 5 rubescentibus

basi longe productis, circiter 8 mm. longis. *Ovarium* globosum, glabrum, apice squamis dentato-setosis coronatum. *Fructus* immaturus calycis segmentis persistentibus accrescentibus coronatus.

NORTHERN NIGERIA. Neill's Valley, 2 miles east of Government Station, Naraguta, 15 June, 1921, $1\frac{1}{2}$ ft. high, petals mauve, *H. V. Lely* No. 259.

Dissotis Lambii, *Hutchinson* in Kew Bull. 1916, 230.

Naraguta, 20 June; 18–24 ins. high, No. 285, 4 Aug., about 5 ft. high, mauve flowers about $3\frac{1}{2}$ ins. in diameter, No. 484.

Previously collected by Mr. Lamb at Kaduna.

Antherotoma Naudinii, *Hook. f.*; Gilg, Monogr. Afr. Melastomac. 9, t. 1, F.

Naraguta, 17 Aug.; small herb about 10 ins. high, 4 mauve petals, No. 536.

Widely distributed in Tropical Africa and Madagascar.

ONAGRACEAE.

Jussiaea diffusa, *Forsk.*; F.T.A. ii. 488.

Bauchi, 2200 ft., in wet marshy places, 13 May, 1 ft. high flowers yellow, No. 172.

Jussiaea villosa, *Lam.*; F.T.A. ii. 489.

Naraguta, decumbent in damp stream bed, flowers yellow, No. 28.

Lemme, 2600 ft., 7 May, No. 93.

FICOIDACEAE.

Glinus lotoides, *Linn.*, var. **virens** (*Oliv.*); F.T.A. ii. 590 (*Mollugo Glinus*).

Takwara, wet places, 3200 ft., 4 May; spreading 2 ft., petals pale mauve with dark central line, No. 101.

Distrib.—Nigeria and Angola.

Mollugo nudicaulis, *Lam.*; F.T.A. ii. 591.

Bichikki, 2200 ft., 17 May; 3–6 ins. high, flowers white, No. 181.

CUCURBITACEAE.

Momordica foetida, *Schum.*; F.T.A. ii. (*M. Morkorra, A. Rich.*).

Vodni, 4600 ft., 13 July, 6 ft., corolla snow white, sepals with black knobs, fruit a large 2–3 ins. oval green berry with orange protuberances, No. 423.

UMBELLIFERAE.

Hydrocotyle asiatica, *Linn.*; F.T.A. iii. 6; Hutch. in *Kew Bull.* 1921, 248.

Naraguta, 20 June; decumbent 2–3 ft., flowers small, red, on short stout stalks, No. 281.

Widely spread in the tropics of the Old World.

Diplolophium abyssinicum, *Benth. & Hk. f.*; F.T.A. iii. 17.
Naraguta, in long grass, 6 Aug., robust perennial Umbellifer, up to 8 or 9 ft., stem streaked with crimson, flowers greenish white, No. 499.
Distrib.—Previously known only from East Africa, from Abyssinia to the Mau Plateau, Uganda.

Pycnocycla occidentalis, *Hutchinson,* sp. nov.; affinis *P. glaucae,* Lindl., sed pedunculis dense pubescentibus, umbellis et bracteis multo majoribus differt.

Herba basi lignosa usque ad 6 dm. alta; caulis basi foliis reductis membranaceis imbricatis indutus, dense pubescens. *Folia* longe petiolata; pinnatipartita, circiter 15 cm. longa, segmentis acicularibus sulcatis acutis rigidis glabris ultimis circiter 2 cm. longis; petioli plerumque circiter 9 cm. longi, subteretes, sulcati. *Flores* polygami in umbellum compositum multiradiatum circiter 5·5 cm. diametro dispositi; involucri bracteae circiter 12, lineari-lanceolatae, acute acuminatae, 1·3 cm. longae, pilis patulis vel subreflexis densissime tomentosae; involucelli bracteae exteriores similes sed paullo breviores et filiformi-acuminatae, interiores multo reductae; pedunculi ultimi 1 cm. longi, villoso-tomentosi. *Calycis lobi* subulati, pubescentes. *Petala* exteriora linearia, 5–6 mm. longa, apice inaequaliter bidentata extra parce puberula. *Flos* foemina dense tomentosa.

Northern Nigeria. Ropp, 4600 ft., 19 July, 1921, 1–2 ft. high, flowers whitish, *H. V. Lely* No. 450.

This is the first record of the genus *Pycnocycla* from Upper Guinea. The species is closely related to *P. glauca,* Lindl., which occurs in Abyssinia and Somaliland and also in Central and N.W. India. The genus is otherwise confined to Asia Minor, mainly in Persia, and is a distinct desert type.

Rubiaceae.

Hymenodictyon floribundum, *B. L. Robinson* in Proc. Amer. Acad. xlv. 404 (1910); F.T.A. iii. 42 (*H. Kurria,* Hochst.)
Neill's Valley, 2 miles east of Naraguta Gov. Station, 15 June; small stout rock shrub, 1–3 ft., spikes of numerous dark red flowers, No. 266.
Distrib.—Eastward to Abyssinia, in Nyasaland and Angola.

Pentas globifera, *Hutchinson,* sp. nov.; affinis *P. verticillatae,* K. Schum. (sp. afr. orient.), sed caulibus satis dense crispato-pilosis, calycibus dense confertis, corollae lobis minoribus differt.

Herba erecta, circiter 45 cm. alta; caulis simplex, laxe foliatus, circiter 5 mm. crassus, breviter strigoso-pubescens, internodiis 4–5 cm. longis. *Folia* ternatim verticillata, obovato-oblanceolata, acuta, basi sensim angustata, 5–8 cm. longa, 2–3 cm. lata, chartacea, utrinque breviter et laxe pubescentia; nervi laterales utrinsecus circiter 7, arcuato-ascendentes, supra leviter prominuli, infra prominentes, nervis tertiariis cum lateral-

ibus subparallelis; stipulae tripartitae, 7–8 mm. longae, segmentis lineari-subulatis parce pubescentibus. *Inflorescentia* terminalis, capitata, circiter 8 cm. expansa; bracteae foliaceae. *Flores* albi. sessiles, 6–7 cm. longi. *Calyx* inaequaliter 5-partitus, segmentis lanceolatis acute acuminatis dorso carinatis parce pubescentibus 6–7 mm. longis. *Corollae tubus* 5·5 cm. longus, superne leviter latior, extra pilis brevibus patulis hirsutus, intra superne dense villosus; lobi 5, oblongo-lineares, obtusi, 7 mm. longi, 2 mm. lati, extra leviter pubescentes, marginibus incurvis. *Stamina* inclusa, 1 cm. infra apicem corollae tubi inserta; antherae 5 mm. longae, basi breviter bilobatae. *Stylus* 1·2 cm. exsertus, glaber, stigmate bilobato ellipsoideo 1·75 mm. longo. *Fructus* non visus.

Northern Nigeria.—Mongu, 4300 ft., 8 July, flowers white, *H. V. Lely* No. 386.

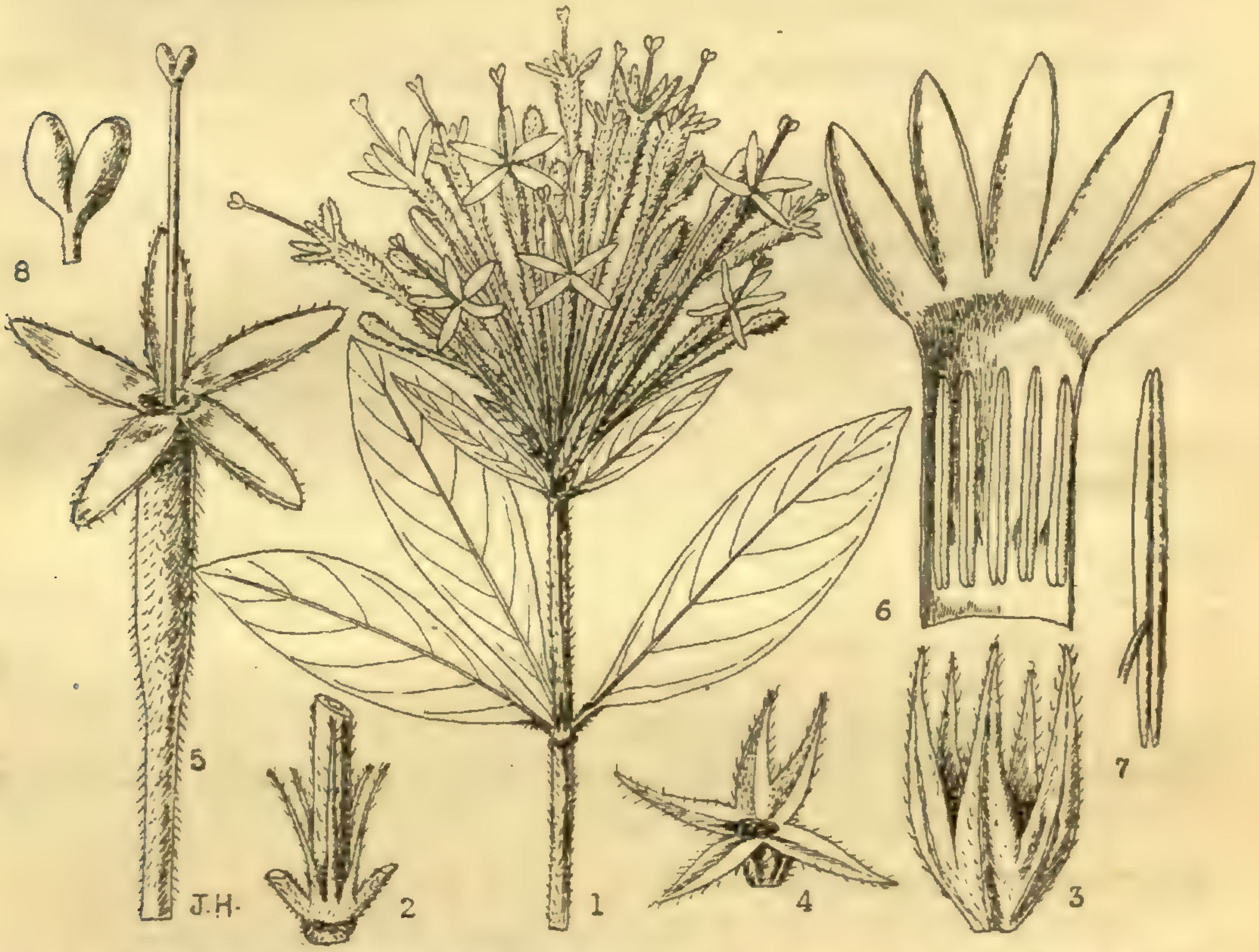

Fig. 5. *Pentas globifera*, Hutchinson. 1, top of flowering branch; 2, stipule; 3, calyx; 4, the same laid open; 5, upper part of corolla; 6, the same showing insertion of stamens; 7, anther; 8, stigmas.—All enlarged except 1 × ½.

Virecta multiflora, *Smith*; F.T.A. iii. 48.

Naraguta, in great masses over flat cleft rocks, 5 Aug.; herb 9–18 ins. high, flowers pale mauve with two darker lines down the corolla lobes, Hausa "Gogamasu," No. 491.

Distrib.—Upper Guinea generally and Uganda.

Oldenlandia senegalensis, *Hiern* in F.T.A. iii. 56; Holland, 353.

Naraguta, in grass country, 1 Aug.; herb about 2 ft. high, small brown petals, No. 471.

Distrib.—Senegambia to the Eastern Sudan and Uganda.

Oldenlandia Heynei, *Oliv.*; F.T.A. iii. 59; Holland, 353.

Naraguta, 6 Aug.; slender herb 1 ft. high, flowers white, corolla 4-lobed, No. 501.

Oldenlandia capensis, *L.f.*; F.T.A. iii. 62.

Mongu, 4300 ft., 18 July; prostrate, flowers white, 4-parted, No. 440.

Taura, 6 May; minute white flowers, No. 121.

Mussaenda arcuata, *Poir.*; F.T.A. iii. 68; Hutch. in *Kew Bull.* 1921, 249; Holland, 354.

Naraguta, on stream banks, 23 June; shrub 6–10 ft., corolla primrose yellow, hairs on the base of the petals chestnut coloured, turning dark brown after maturity, No. 322.

Distrib.—Sierra Leone across Northern Tropical Africa, south to the Zambesi Basin.

Mussaenda erythrophylla, *Schum. et Thonn.*; F.T.A. iii. 69; Holland, 354.

Naraguta, 20 June; a large shrub 10–30 ft., on stream banks, climbing over trees, corolla tubular, bright yellow or cream within, red and hairy outside, one of the 5 sepals enlarged and vivid red, No. 288.

A most beautiful shrub ranging from Sierra Leone through the hinterland at fairly high altitudes to Angola, the South Eastern Sudan (Monbuttuland), and Uganda.—Figured in the Botanical Magazine, t. 8222.

Sabicea brevipes, *Wernham*, Monogr. Sabicea, 58 (1914).

Naraguta, 20 June; 2–3 ft. high, tough and woody, white flowers in clusters, No. 284.

Vodni, 4600 ft., 13 July, climbing 3–5 ft., heads of pink tubular flowers, No. 427.

Distrib.—Known previously only from Togoland; there is evidently variation in the colour of the flowers.

Macrosphyra longistyla, *Hook. f.*; F.T.A. iii. 106.

Naraguta; 4–8 ft., flowers greenish white, No. 83.

Distrib.—Sierra Leone to Northern Nigeria and in Niamniamland.

A very beautiful shrub, formerly cultivated in our greenhouses and worthy of reintroduction; the flowers are rather variable in length and degree of indumentum and are heavily scented.

Pentanisia Schweinfurthii, *Hiern*; F.T.A. iii. 131; Hutch. in *Kew Bull.* 1921, 250.

Naraguta, 3–4 ins. in clumps, flowers bright blue, No. 3.

Distrib.—Northern Nigeria and East Africa.

Vangueria Dalzielii, *Hutchinson* in *Kew Bull.* 1913, 179; Holland, 360.

Naraguta, shrub 4 ft., flowers green, No. 64.

Distrib.—So far recorded only from Northern Nigeria.

Fadogia Cienkowskii, *Schweinf.*; F.T.A. iii. 154.

Naraguta, 18 ins. high, flowers yellow, No. 48.

Distrib.—Northern Nigeria to Senaar.

The Southern plant referred to this species in the Flora of Tropical Africa is a distinct species.

Fadogia obovata, *N. E. Br.* in *Kew Bull.* 1906, 105.

Naraguta, 25 June; in clumps 24–30 ins. high, stem triangular, ribbed, corolla pale green, No. 326.

Distrib.—This species was gathered in the Kontagora Province in 1911 by Dr. J. M. Dalziel. It has previously not been known except from South East Tropical Africa, where it ranges from North Nyasaland to North Western Rhodesia. The plants from these two distant regions are apparently not separable.

Psychotria Vogeliana, *Benth.*; F.T.A. iii. 210.

Tilde Filani, river bank, 3300 ft., 24 May; shrub 4–5 ft., small white flowers, No. 228.

Distrib.—Gold Coast to the Congo.

Diodia scandens, *Swartz*; F.T.A. iii. 231 (*D. breviseta*, Benth.).

Tilde Filani, 3300 ft., 1 ft. high, small white flowers, No. 225.

Spermacoce filiformis, *Hiern* in F.T.A. iii. 234.

Naraguta, moist places amongst rocks, 8 Aug.; herb 10 ins. high, stems red, flowers white, No. 503.

Distrib.—Endemic to Northern Nigeria.

Spermacoce hebecarpa, var. **major,** *Schweinf.*; F.T.A. iii. 237.

Naraguta, grass lands, 1 Aug.; herb about 1 ft. high, stems bright red, whorls of mauve flowers, No. 473.

Distrib.—Eastern Sudan.

Spermacoce radiata, *Sieb.*; F.T.A. iii. 237.

Naraguta, 1 Aug., about 1 ft. high, flowers white, No. 474.

Distrib.—North Tropical Africa.

Spermacoce globosa, *Schum. & Thonn.*; F.T.A. iii. 240.

Naraguta, in clumps, No. 21.

Tilde Filani, 3300 ft., 24 May, 2 ft. high, spherical heads of white flowers, No. 227.

Distrib.—Cape Verde Islands, Senegambia to Angola.

Octodon setosum, *Hiern*; F.T.A. iii. 242.

Plains between Hepham & Ropp, 4600 ft., 5 July, 15 ins. high, heads of pink flowers, No. 369.

Distrib.—Gold Coast to Nigeria, common in wet places in Northern Nigeria.

Mitracarpum scabrum, *Zucc.*; F.T.A. iii. 243; Holland 378.

Mongu, 4300 ft., 8 July, flowers white, Nos. 399, 400.

Distrib.—Cape Verde Islands and common in Africa.

Compositae.

Ethulia conyzoides, *Linn.*; F.T.A. iii. 262.

Naraguta, 6 ins. high, flowers mauve, No. 37.

Gutenbergia Ruppellii, *Sch. Bip.*; F.T.A. iii. 263.

Naraguta, 26 July, common herb by the roadsides on open land, 2 ft. high, flower heads purple, No. 464.

Distrib.—Known up to the present only from Abyssinia and Kenya Colony.

Gutenbergia nigritana, *Oliv. & Hiern*; F.T.A. iii. 264.

Naraguta, 9–12 ins., heads purple, No. 52.

Distrib.—Also in Southern Nigeria and apparently endemic to the Colony.

Vernonia Perrottetii, *Sch. Bip.*; F.T.A. iii. 272; Holland, 380.

Ropp, 4600 ft., 19 July, 12–18 ins., flowers purple, No. 448.

Distrib.—North and South Tropical Africa.

Fig. 6. *Vernonia saussureoides*, Hutchinson.—part of flowering shoot, × ⅔; 1, flower; 2, stamens; 3, style arms; 4, achene; 5, pappus hairs., enlarged.

Vernonia ambigua, *Kotschy & Peyr.*; F.T.A. iii. 272.

Neill's Valley, 2 miles east of Naraguta Government Station, 15 June, No. 268. Plains between Hepham and Ropp, 4600 ft., 5 July, 18 ins., No. 358. Naraguta, grass country, 1 Aug., herb about 18 ins., flowers mauve, No. 476.

Distrib.—North Tropical Africa and Angola.

Vernonia cinerea, *Less.*; F.T.A. iii. 275; Holland, 379.

Naraguta, 2–4 ft., heads purple, No. 10.

Vernonia saussureoides, *Hutchinson*, sp. nov., inter species africanas aspectu *Saussurei* valde distincta.

Caules plures usque ad 1 m. alti, costati, glabri, circiter 3 mm. crassi, lignosi. *Folia* densiuscula, ascendentia, oblanceolata, apice subacute triangularia, basi longe cuneata, 4–7 cm. longa, 1–2 cm. lata, rigide coriacea glabra utrinque prominenter nervosa, supra nitidula laxe reticulata marginibus integris recurvatis; nervi laterales utrinsecus 5–6, ascendentes. *Capitula* terminalia subsessilia, pauca, subcorymbosa. late turbinata, pallide coerulea, circiter 2 cm. longa et apice 1·5 cm. diametro. *Involucri bracteae* 7–8-seriatae ab exteriore gradatim longiores, exteriores triangulari-ovatae, acutae, interiores oblongo-lanceolatae, usque ad 1·4 cm. longae, purpuratae, marginibus lanatis. *Corollae tubus* 1·5 cm. longus; lobi lineari-lanceolati, subacuti, 5 mm. longi. *Antherae* 5 mm. longae, subacute acuminatae, basi sagittatae. *Styli* rami 4 mm. longi, minute puberuli. *Achaenia* oblonga, minute et parce puberula. *Pappi setae* numerosae, stramineae, exteriores breviores circiter 6 mm. longae, interiores corollae tubo aequilongae.

NORTHERN NIGERIA. Naraguta, 20 June, 1921, 2–3 ft. high, flowers cornflower-blue, *H. V. Lely* No. 286.

A very distinct plant with the habit of a *Saussurea*, not related to any particular Tropical African species of *Vernonia*.

Vernonia purpurea, *Sch. Bip.*; F.T.A. iii. 281.

Plains between Hepham & Ropp, 4600 ft., 1 ft. high, heads single, purple, No. 375; 3 ft. high, heads corymbose, No. 376. Ropp, 4600 ft., 19 July, 18 ins., No. 452.

Vernonia nigritana, *Oliv. & Hiern* in F.T.A. iii. 288; Holland, 380.

Ropp, 4600 ft., 19 July, 12–18 ins., deep red inflorescence, No. 458.

Distrib.—Senegambia to Northern Nigeria; described by Barter as a highly ornamental plant with fine crimson flowers.

Vernonia Kotschyana, *Sch. Bip.*; F.T.A. iii. 289; Holland, 380.

Mongu, 4300 ft., 8 July, 15 ins., all the bracts white, flowers mauve, No. 385.

Distrib.—North Tropical Africa from Northern Nigeria to the Red Sea.

Vernonia procera, *O. Hoffm.* in Bull. Soc. Bot. Fr. lv. Mem. viii. 39.

Naraguta, 4000 ft., 3 ft., flowers mauve, No. 70, 30 May No. 242.

Distrib.—Southern Nigeria to the Chari.

Vernonia glaberrima, *Welw. ex O. Hoffm.* in Bol. Soc. Brot. xiii. 15.

Naraguta, 3–4 ft., heads white, Nos. 65, 75.

Distrib.—Here and there over most of the African plateau, especially in Angola and the Zambesi Basin.

Vernonia lappoides, *O. Hoffm.* in Bol. Soc. Broter. xiii. 19 (1896).

Ropp, 4600 ft., 19 July, 1 ft. high, flowers mauve, No. 453.

Distrib.—Angola and the Congo State.

Vernonia oocephala, *Baker* in *Kew Bull.* 1895, 68.
Naraguta, 7 May, 1½–2 ft., heads white, No. 67.
Distrib.—Northern Nigeria and North Nyasaland.

This is a record of considerable interest. *Vernonia oocephala* is a very outstanding member of the genus, and is not closely related with any other African species. Hitherto it has only been known from near Fwambo, North Nyasaland, about 2200 miles away, where it was discovered by A. Carson in 1894.

Aedesia Baumannii, *O. Hoffm.* in Engl. Jahrb. xxiv. 468.
Naraguta, wet places, 10 June; flowers yellow, No. 253.
Distrib.—Gold Coast to Northern Nigeria.

Ageratum conyzoides, *Linn.*; F.T.A. iii. 300; Holland, 381.
Naraguta, 10 ins. high, flowers mauve, No. 39.

Eupatorium africanum, *Oliv. & Hiern* in F.T.A. iii. 301.
Top of Zaranda mountain, 5800 ft., 18 May, 2–2½ ft., flower heads white, No. 191.

Mikania scandens, *Willd.*; F.T.A. iii. 301; Holland, 382.
Naraguta, 23 June, climbing or upright, 1–3 ft., flowers white with a blush of pink, No. 321.

Microglossa volubilis, *DC.*; F.T.A. iii. 309.
Mongu, 4300 ft., 8 July, shrub 4–5 ft., flowers cream, No. 397.

Microglossa angolensis, *Oliv. & Hiern* in F.T.A. iii. 309.
Plain between Bukuru and Hepham, 4300 ft., 4 July, 18 ins., outer heads pale yellow, inner darker, No. 347.
Distrib.—Southward to Angola.

Dicrocephala latifolia, *DC.*; F.T.A. iii. 303.
Plains between Hepham and Ropp, 4600 ft., 5 July, 6–12 ins., flower heads mauve, No. 368.

Conyza persicaefolia, *Oliv. & Hiern* in F.T.A. iii. 312.
Naraguta, 6 ft., flowers yellow, No. 45.
Tilde Filani, 3300 ft., 24 May, 1½–3 ft., flowers golden, No. 234.

Blumea aurita, *DC.*; F.T.A. iii. 322.
Bauchi, 2200 ft., 13 May, 12–18 ins., flower heads green, No. 170.

Blumea lacera, *DC.*; F.T.A. iii. 322.
Baradau, 3000 ft., 3 May; 1–2 ft. flowers golden, No. 92.

Laggera oblonga, *Oliv. & Hiern*; F.T.A. iii. 327.
Naraguta, 6 ins. high, heads white, No. 54.
Distrib.—Sierra Leone to the Congo.

Gnaphalium luteo-album, *Linn.*; F.T.A. iii. 343.
Baradau, 3000 ft., 3 May, up to 2 ft. high, heads silky, flowers pale gold, No. 84.
Takwara, 3200 ft., 4 May, No. 107.

Pulicaria crispa, *Clarke ;* F.T.A. iii. 366; Holland, 384.
Lemme, 2600 ft., up to 12 ins., flowers yellow, No. 131.

Sclerocarpus africanus, *Jacq. ;* F.T.A. iii. 374.
Panyam, 4500 ft., 17 July, 2 ft. high, outer florets 3–4, small and yellow, No. 438.

Wedelia africana, *Beauv. ;* F.T.A. iii. 376.
Naraguta, 1 ft. high, flowers bright yellow, No. 60.
Distrib.—Upper Guinea.

Aspelia helianthoides, *Oliv. & Hiern* in F.T.A. iii. 381.
Jos, 22 June, 1–2 ft. high, flowers pale yellow, No. 312.
Distrib.—Gold Coast to Loanga.

Melanthera Chevalieri, *O. Hoffm. & Muschler* in Bull. Soc. Bot. Fr. lvii. Mem. viii. 117 (1910).
Plains between Hepham and Ropp, 4600 ft., 5 July, 3–4 ft., flowers orange, No. 379.
Distrib.—Chari Region.

Eclipta alba, *Hassk.*; F.T.A. iii. 373; Holland, 384.
Jira, 2 May, 1 ft., flowers white, No. 128.

Spilanthes Acmella, *Linn. ;* F.T.A. iii. 384; Holland 389.
Tilde Filani, 3500 ft., 24 May, No. 233.

Coreopsis Barteri, *Oliv. & Hiern* in F.T.A. iii. 390.
Naraguta, also in large masses covering Jos hills in September, 3 ft., flowers golden, No. 43.
Distrib.—Endemic to Nigeria.

Bidens pilosa, *Linn. ;* F.T.A. iii. 392; Holland, 389.
Naraguta, Nos. 42, 46, 276. Neill's Valley, No. 267.
Mongu, 4300 ft., No. 396.

Chrysanthellum procumbens, *Pers. ;* F.T.A. iii. 395.
Lemme, 2600 ft., 7 May, leaves forming a rosette, flowers yellow, Nos. 94, 132.

Tridax procumbens, *Linn.*
Naraguta, 12 ins. high, flowers cream coloured, No. 55.
Distrib.—An introduced Asiatic weed not recorded in the Flora of Tropical Africa; near Lagos it is a common weed on golf courses (Dalziel).

Gynura cernua, Benth.; F.T.A. iii. 402; Holland 390.
Naraguta, 18 ins. high, flowers purple or white, No. 35.

Coreopsis camporum, *Hutchinson*, sp. nov.; affinis *C. Kirkii*, Oliv. et Hiern, sed foliis multo longioribus marginibus minute setulosis dentibus longe setosis pedunculis brevioribus bracteis exterioribus herbaceis linearibus differt.

Herba 1–1·25 m. alta, basin versus dense foliata, superne corymboso-ramosa; caulis conspicue striatus, glaber. *Folia* basalia simpliciter vel rarius bipinnata, usque ad 12 cm. longa, glabra, sicco laete viridia, segmentis linearibus vel linearilanceolatis acutis ad 5·5 cm. longis et 7 mm. latis marginibus

minute setulosis et interdum parce dentatis dentibus e basibus triangularibus longe setosis. *Capitula* numerosa, subcorymbosa, circiter 2–2·5 cm. expansa, pedunculis terminalibus circiter 1 cm. longis, lateralibus usque ad 4 cm. longis superne puberulis. *Involucri bracteae* biseriatae, exteriores herbaceae, patulae, circiter 12, lineares, acutae, 1–1·5 cm. longae, margine setuloso, interiores ascendentes oblongo-lanceolatae, obtuse acuminatae, circiter 6 mm. longae et 2 mm. latae, crebre resinoso-striatae. *Flores radii* flavi, fertiles; corollae tubus 2·5 mm. longus, leviter pubescens; limbus oblongo-ellipticus, apice breviter bilobatus, 1·1 cm. longus, 4 mm. latus, 9–nervius. *Pappus* hirsutus. *Flores disci:* corollae tubus 2 mm. longus, glaber, lobis triangularibus. *Achaenia* complanata, 4–5 mm. longa, ciliato-pubescentia, setis rigidis geminatis 2·5 mm. longis coronata. *Receptaculi bracteae* oblongo-oblanceolatae, minute mucronatae, 5·5 mm. longae, 1·5 mm. latae, medio striatae, marginibus hyalinis.

Northern Nigeria. Plains between Hepham and Ropp, 4600 ft., 5 July, 1921, 2 ft. high, flowers orange, *H. V. Lely* No. 383. Ropp, 4600 ft., 19 July, 1921, 3–4 ft. high, *H. V. Lely* No. 449.

Senecio abyssinicus, *Sch. Bip.*; F.T.A. iii. 410; Holland, 391.

Naraguta, 8 ins. high, flowers yellow, No. 32.

Distrib.—Nigeria to Abyssinia and in South Tropical Africa.

Senecio baberka, *Hutchinson* in Kew Bull. 1913, 180; Holland, 391.

Naraguta, 10 ins. high, flowers bright yellow, Nos. 13, 59.

Distrib.—Endemic to Northern Nigeria.

Senecio Hochstetteri, Sch. Bip.; F.T.A. iii. 414.

Plains between Hepham and Ropp, 4600 ft., 18 ins., flowers pale yellow, No. 364.

Distrib.—Known hitherto only from the Abyssinian and East African mountains, from 5000–8000 ft.

Senecio Lelyi, *Hutchinson*, sp. nov., habitu *S. penticosti*, Hiern (spec. angolensi), sed foliis inferioribus multo minoribus achaeniis dense pubescentibus differt.

Herba (perennis ?) usque ad 50 cm. alta, gracilis; caules simplices, paucifoliati, sulcati, glabri, basin versus circiter 3 cm. crassi. *Folia* sessilia, lineari-lanceolata, acuta, basi semiamplexicaulia, 5–8 cm. longa, 6–8 mm. lata, glabra, crebre serrulata. *Capitula* 3–4-corymbosa, pedunculata, circiter 1·5 cm. expansa. *Involucri bracteae* 12–14, oblongo-lanceolatae, subacutae, circiter 1 cm. longae, 2·5 mm. latae, glabrae, medio crassae, marginibus late hyalinis; bracteae exteriores paucae, inferioribus dimidio breviores. *Flores radii* flavi, pauci. *Flores disci* fere 1 cm. longi. *Achaenia* dense pubescentia. *Pappi setae* albae, 7 mm. longae.

Northern Nigeria. Plains between Hepham and Ropp, 4600 ft., 5 July, 1921, *H. V. Lely* No. 356.

Echinops longifolius, *A. Rich.*; F.T.A. iii. 431.

Naraguta, 4000 ft., 30 May, flowers white, leaves white below, No. 247.

Distrib.—North Tropical Africa.

Centaurea nigerica, *Hutchinson*, sp. nov., *C. solstitiali*, Linn., remote affinis, sed foliis majoribus, involucri bracteis pectinatis vix spinosis differt.

Herba erecta, usque ad 1 m. alta, superne parce ramosa; caules et rami foliis decurrentibus anguste alati, arachnoideo-villosi. *Folia* linearia vel lineari-oblanceolata, acute apiculata basi decurrentia, 6–8 cm. longa, 0·6–1 cm. lata, firme chartacea vel fere coriacea, integra, utrinque scabrida et etiam tenuiter arachnoideo-villosa, nervis paucis ascendentibus infra conspicuos *Capitula* solitaria, terminalia, sessilia, circiter 3·5 cm. diametr.

Fig. 7. *Centaurea nigerica*, Hutchinson. 1, inner involucral bract; 2, stamen; 3, style; 4, flower; 5, achene & pappus.

et 3 cm. longa. *Involucrum* globoso-campanulatum, superne contractum, circiter 1·5 cm. diametro; bracteae 6–7-seriatae, apice pectinatae, segmentis lineari-filiformibus 2·5–3 mm. longis cartilagineis glabris. *Flores* pallide roseo-coerulei. *Receptaculi* setae albae, filiformes 7–8 mm. longae. *Corollae* tubus anguste cylindricus, superne leviter et sensim ampliatus longitudinaliter nervosus, glaber, lobis linearibus obtusis 5 mm.

longis. *Antherae* 4 mm. longae, filamentis pubescentibus. *Pappi setae* leviter inaequales, albae, 2–3 mm. longae.

NORTHERN NIGERIA. Naraguta, 10 June, 1921, 2–3 ft. high, *H. V. Lely* 252.

Centaurea praecox, *Oliv. & Hiern* in F.T.A. iii. 438.

Naraguta, 2–3 ins. high, outer florets white, inner purple, No. 58.

Distrib.—A rare species confined to Northern Nigeria; it was discovered by Barter (No. 1223) in Yoruba and was subsequently gathered by Dalziel (No. 405) in Sokoto Province. The flower-heads are borne on the stem quite close to the ground, the leafy shoots afterwards elongating and barren.

Picris humilis, *DC.*; ex descriptione; F.T.A. iii. 448, in obs.

Naraguta, 4000 ft., 1 ft. high, flowers yellow, No. 24; 18 ins. high, 30 June, No. 341.

This is very probably *Picris humilis*, DC. Prodr. vii. 130, known only from an imperfect specimen collected by Leprieur in Senegal, and not seen by the authors of the Flora of Tropical Africa. It was also gathered in the Katagum district by Dr. J. M. Dalziel (No. 392). The species is easily mistaken for *P. abyssinica*, Sch. Bip., from Abyssinia but the achenes in that species are not attenuated as in the Nigerian plant.

Lactuca capensis, *Thunb.*; F.T.A. iii. 452.

Lemme, 2600 ft., 7 May; 1–2 ft., flowers mauve or purple, Nos. 22, 136.

Naraguta, 4000 ft., 30 June, 4–5 ft. high, flowers purple, No. 338.

Lactuca Welwitschii, *Scott Elliott* in Journ. Linn. Soc. xxix. 30 (1891).

Naraguta, 8 Aug., open grass lands, 1 ft. high, heavy tap root, No. 512.

Distrib.—Congo and Angola.

EBENACEAE.

Maba secundiflora, *Hutchinson*, sp. nov., foliis leviter oblique lanceolatis utrinque attenuatis ciliatis floribus solitariis axillaribus secundis facile distinguenda. (*See* p. 385.)

Frutex ad 4 m. altus; rami vetustiores cinerei, glabrescentes, ultimi dense foliati, ferrugineo-tomentosi. *Folia* oblique lanceolata, utrinque attenuata, obtusa, 4–6 cm. longa, 1–1·6 cm. lata, tenuiter coriacea, margine cartilagineo ciliato, utrinque fere glabra et reticulata; costa infra conspicua, pubescens; nervi laterales numerosi, patuli, multe ramosi; petioli 3 mm. longi, dense pilosi. *Flores* ♀ tantum visi, axillares, secundi, trimeri, reflexi, fere ebracteati; pedicelli 2 mm. longi, tomentosi. *Calyx* campanulatus, leviter et obtuse 3-lobatus, 5 mm. longus, utrinque dense ferrugineo-hirsutus. *Corolla* calyce leviter exserta, superne extra appresse pilosa; tubus cylindricus, 3·5 mm.

longus, lobis ovato-rotundatis marginibus glabris undulatis dorso appresse villosis. *Ovarium* ovoideum, villosum, triloculare, loculis biovulatis. *Fructus* stramineus, oblique oblongus, mucronatus, 1·5 cm. longus, parce appresse lanatus, basi calyce persistente cupulare 4 mm. longo circumdatus.

Northern Nigeria. Tilde Filani, 3300 ft., 24 May, shrub about 12 ft. high on banks of streams, flowers brownish, pendant on the underside of the branchlets, *H. V. Lely*, No. 229.

Katagum district, in ravines, fruiting specimen, *J. M. Dalziel*, No. 413.

A very distinct species rather closely related to one from Nyasaland as yet undescribed. Male flowers are not yet known.

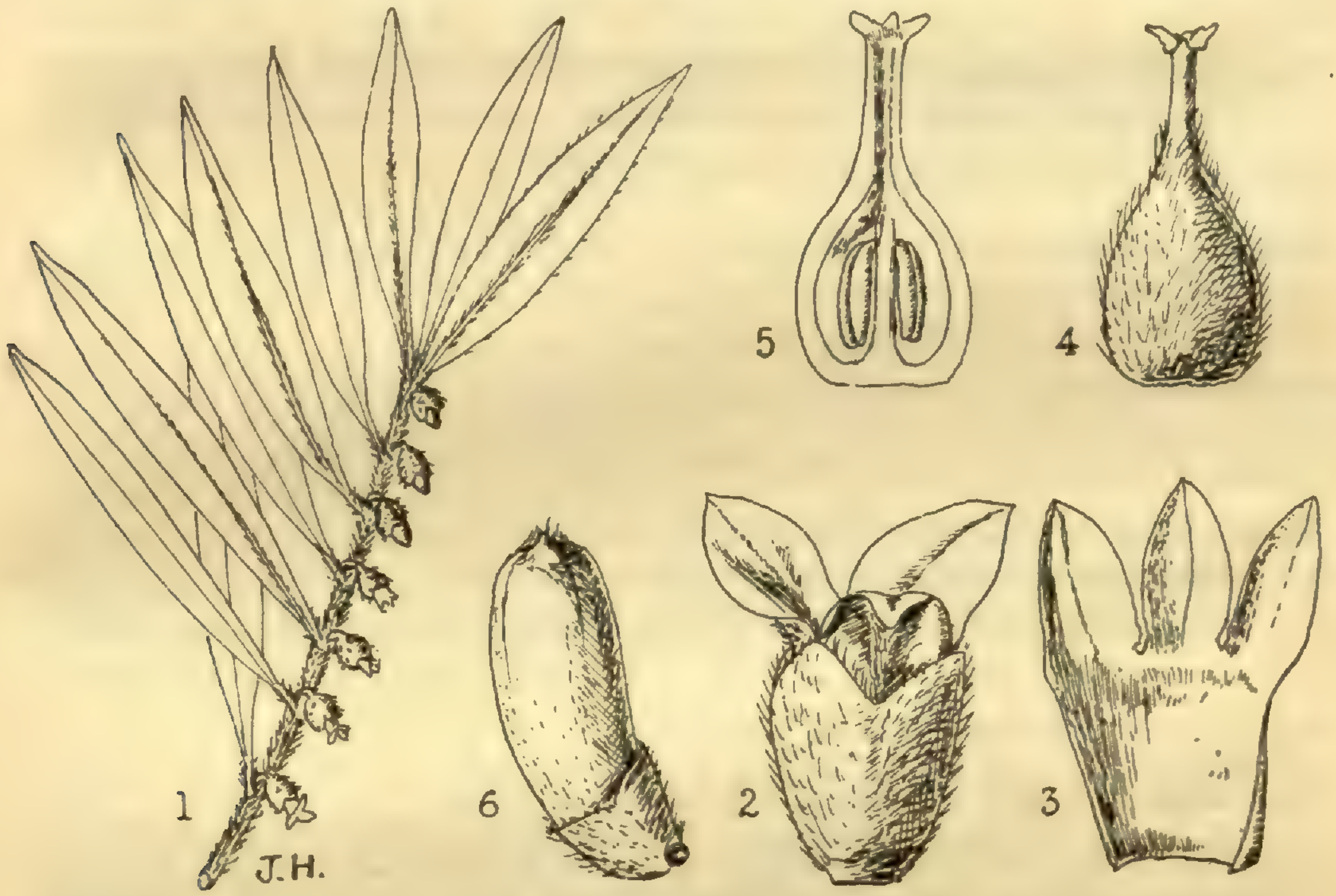

Fig. 8. *Maba secundiflora*, Hutchinson. 1, female flowering shoot, × ⅔; 2, fem. flower; 3, corolla opened out; 4, pistil; 5, longitudinal section of same; 6, fruit—enlarged. (*See* p. 384.)

Campanulaceae.

Wahlenbergia riparia, *A.DC.*; F.T.A. iii. 480.

Takwara, 3200 ft., 4 May, 1–2 ft., flowers flax-blue, No. 108.
Taura, 1 ft., 6 May, No. 120.

Oleaceae.

Jasminum obtusifolium, *Baker*; F.T.A. iv. i. 4.

Lemme, on stream banks, 7 May; shrub 10 ft., flowers white, sweet-scented, No. 157.

Distrib.—An endemic North Nigerian species.

Jasminum pauciflorum, *Benth.*; F.T.A. iv. i. 6.

Naraguta, 10 June, No. 251.

Distrib.—Sierra Leone to Nigeria and in Uganda.

Jasminum ternifolium, *Baker*; F.T.A. iv. i. 9.
Tilde Filani, 3300 ft., 24 May; shrub 3–5 ft., flowers snow white, No. 235.
Distrib.—Northern Nigeria to Bongoland, and in Angola.

Jasminum mauritianum, *Bojer*; F.T.A. iv. i. 10.
Naraguta, 1½–2 ft., flowers cream coloured, fruits black, No. 61.
Distrib.—Apparently very variable and widely distributed in East and South Tropical Africa; our plant matches very well with specimens from Mauritius, the type locality.

Apocynaceae.

Landolphia amoena, *Hua*; F.T.A. iv. i. 46.
Naraguta, climber, flowers white, scented, No. 50.
Distrib.—French Guinea to the Chari.

Carissa edulis, *Vahl*; F.T.A. iv. i. 89; Holland, 438.
Naraguta, on stream banks, bush 10–12 ft., flowers pink, sweet scented, No. 49.

Asclepiadaceae.

Cryptolepis nigritana, *N.E.Br.* in F.T.A. iv. i. 251.
Naraguta, 2 ft., flowers yellow, No. 63.
Nabardo, 2300 ft., 20 May, 2–3 ft., stem rough and sticky, flowers yellow, No. 216.
Distrib.—Togoland to East Africa.

Tacazzea Barteri, *Baill.*; F.T.A. iv. i. 266.
Lemme, 7 May, climbing, flowers green, No. 152.
Distrib.—This is the first gathering of this species in Northern Nigeria since discovered by Barter in Nupe. Chevalier records the species from the French Sudan and Dahomey, but his specimens have not been seen by the writer (see Chevalier Expl. Bot. Afr. Occid. Fr. i. 429 (1920)).

Tacazzea apiculata, var. **benedicta,** *Scott Elliot*; F.T.A. iv. i. 267.
Tilde Filani, 3300 ft., 24 May, twining 15 ft., flowers greenish, No. 231.

Kanahia glaberrima, *N.E.Br.* in F.T.A. iv. i. 297.
Jira, river beds and banks, 2 May, 4–5 ft., flowers white, sweet scented, No. 125.
Distrib.—East Africa and Angola.

Xysmalobium Heudelotianum, *Decne.*; F.T.A. iv. i. 304.
Bichikki, 2200 ft., 17 May; 6 ins., flowers green and purple, No. 177.
Mongu, 4300 ft., 18 July; 18 ins., No. 439.
Distrib.—Senegambia to Northern Nigeria.

Asclepias lineolata, *Schltr.*; F.T.A. iv. i. 322; Holland, 465.
Tilde Filani, 3300 ft., 24 May; 24–30 ins. petals green, veined with purple, No. 236.
Distrib.—From Nigeria east and southwards over most of Tropical Africa.

Oxystelma bornouense, *R.Br.*; F.T.A. iv. i. 383.
Lemme, 2600 ft., river banks, 7 May; climbing 10–12 ft., flower deeply purple veined, grey underneath, No. 144.
Distrib.—Senegal to Somaliland.

Sarcostemma viminale, *R.Br.*; F.T.A. iv. i. 384.
Takwara, 3200 ft., 4 May, flowers cream coloured, No. 109.

Margaretta inopinata, *Hutchinson*, sp. nov.; affinis *M. Whytei*, K. Schum., sed inflorescentiis solitariis brevissime pedunculatis pedicellis brevissimis, coronae lobis flavis differt.

Caules 15–30 cm. alti, simplices, pubescentes. *Folia* patula, oblongo-linearia vel oblongo-lanceolata, acuta, basi rotundata, 3–5·5 cm. longa, 0·5–1·1 cm. lata, chartacea, utrinque setuloso-pubescentia, marginibus recurvis hispidulis. *Inflorescentia* terminalis, breviter pedunculata, circiter 5-flora; pedunculus molliter tomentosus, circiter 5 mm. longus; pedicelli 1–2 mm. longi; bracteae subulatae, puberulae, 3 mm. longae. *Calycis segmenta* lanceolato-subulata, acuta, 3·5 mm. longa, dense pubescentia. *Corollae segmenta* oblongo-linearia obtusa, membranacea, venosa, 7 mm. longa, glabra. *Coronae lobi* petaloidei, flavi, spathulati, superne integra, 8 mm. longi, 4 mm. lati, infra medium dentibus 3 inflexis. *Antherae* appendiculi erecti, triangulari-acuti, 1·5 mm. longi. *Stylus* truncatus.

Northern Nigeria. Plains between Hepham and Ropp 4600 ft., 5 July, 1921, root a stout swollen tuber, flowers (coronal lobes) bright yellow, *H. V. Lely* No. 366.

Up to the present the genus *Margaretta* has been recorded only from East Africa, from Uganda to South Rhodesia. The occurrence of an undescribed species in Northern Nigeria is interesting. The specimen before us bears a solitary immature hairy beaked fruit, borne on a long elongated peduncle (about 10 cm.) situated opposite the flowering inflorescence between the topmost pair of leaves.

Ceropegia Ledermannii, *Schlechter* in Engl. Bot. Jahrb. li. 154 (1913). (*See* p. 388.)

Takwara, 3200 ft. 4. 6. 1921, No. 110.

This plant has been identified from the original description, but there is little doubt as to the correctness of the determination owing to the striking nature of the flowers with their long filiform-linear lobes arising from a triangular base and the presence of a subulate tooth between each. Schlechter's description was drawn up from specimens collected near Kei-Buba in the Northern Cameroons. In the following, probably minor points, the Nigerian specimens differ from the details given by Schlechter :—the leaves are on the whole longer and broader,

up to 8·5 cm. long and 7 mm. broad; the corolla has in the largest flower a length of 1·4 dm., the tube being 8 cm. long; the long green corolla segments are pilose but not densely so; the teeth of the outer corona are 1·5 mm. high and the lobes of the inner corona 4 mm. high.

Schlechter places the affinity of the plant with the South African *C. tomentosa*, Schl. but it is much more nearly related to *C. abinsica*, N.E.Br. (W. B. Turrill).

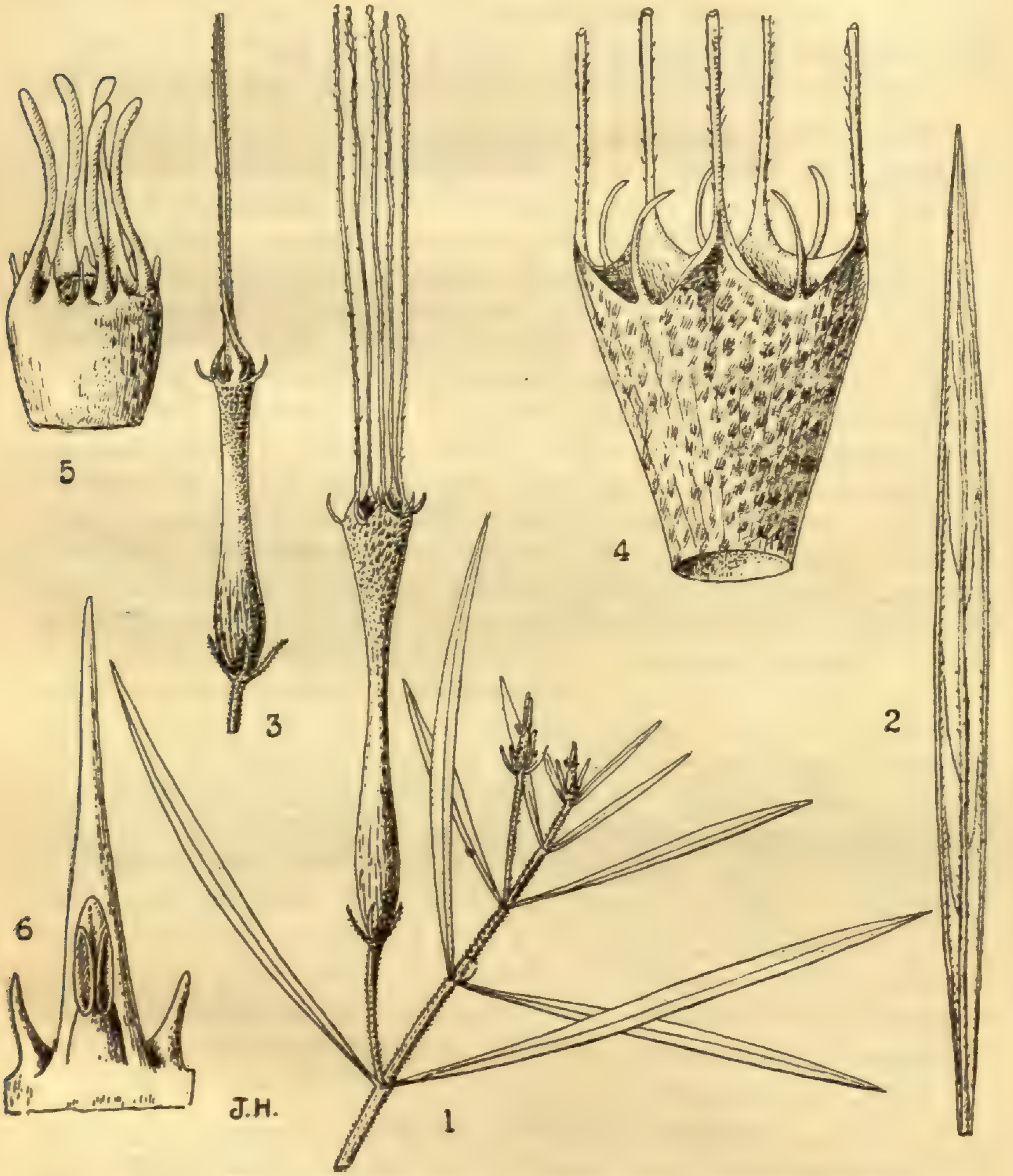

Fig. 9. *Ceropegia Ledermannii*, Schlechter. 1, portion of flowering branch, × ⅔; 2, leaf, × 1½; 3, flower just before opening, × ⅔; 4, enlarged portion of corolla showing base of lobes and intermediate appendages; 5, corona; 6, corona lobe from within. (*See* p. 387.)

Ceropegia rhynchantha, *Schlechter* in Engl. Bot. Jahrb. li. 155 (1913).

Naraguta, climbing 2–3 ft., amongst rocks, No. 550;
Naraguta, trailing in rock crevices over grass, 3–4 ft.

long, No. 523; Kadaura, 30 miles east of Jos, 19 Sept., No. 599.

The above specimens have been identified from Schlechter's original description of a plant from Kokumi in Northern Cameroon. As indicated by Mr. Lely there is a certain amount of variation in the colour of the corollas and also, as seen in his specimens, in the breadth of the leaves (W. B. Turrill).

Ceropegia pedunculata, *Turrill*, sp. nov.; affinis *C. angustae*, N. E. Br.,sed foliis hispidulis floribus multo minoribus distinguitur.

Herba perennis, volubilis. *Caulis* ramique filiformes, flexuosi, glabri. *Folia* patula, lineari-lanceolata, acutissima vel obtusa sed mucronata, basi rotunda, subpeltata, usque as 5 cm. longa, saepissime 3 cm. longa, 3–8 mm. lata, costa media in pagina inferiore prominente hispidula superiore sulcata, nervis lateralibus utrinque inconspicuis, supra omnino hispidula, infra costa media margineque excepta glabra; petioli circiter 3 mm. longi, hispidi. *Cymae* extra-axillares, umbelliformes, pauciflorae; pedunculus 1·5–5 cm. longus, glaber; pedicelli circiter 5 mm. longi, glabri; bracteae minutae, anguste lineares. *Sepala* lineari-lanceolata, superne attenuato-acuminata, 2·5 mm. longa, 1 mm. lata, glabra. *Corolla* tubulosa, extra glabra; tubus 1·6 cm. longus, basem versus 4 mm. diametro, medio constrictus, 3 mm. diametro, fauce gradatim ampliatus, 6 mm. diametro; segmenta e basi triangularia linearia, 1·3 cm. longa, 2 mm. lata, apice acuta leviter connata. *Corona exterior* 2 mm. longa, dentibus 10 plus minusve longe pilosis instructa. *Corona interior* 4 mm. longa, lobis 5 linearibus erecto-conniventibus glabris praedita. *Ovaria* anguste cylindracea, 1·5 cm. alta, glabra.

Northern Nigeria. Bornu Road and Kilba country, 4.8.1909, *J. M. Dalziel* 96. Naraguta, 5.8.1921, plant trailing in rock-crevices, 3–4 ft. long; corolla red, brown and green, Hausa name "Kafan Fakara" (Partridge Foot), *H. V. Lely* No. 495.

Leptadenia lancifolia, *Decne.*; F.T.A. iv. i. 430; Holland 466.
Lemme, 2600 ft., 7 May; climbing and spreading 2–4 ft., whitish flowers in clusters, No. 137.

Distrib.—North Tropical Africa.

Gentianaceae.

Exochaenium pumilum, *A. W. Hill* in *Kew Bull.* 1908, 337.
Belmontia pumila, Baker; F.T.A. iv. i. 552.
Naraguta, small plant in marsh ground, only one example found, 17 Aug.; 2 ins., flowers white, sepals keeled, No. 542.

Distrib.—A tiny Gentianaceous plant originally found by Barter in a swamp at Lom, and not found again until collected by Mr. Lely.

Exochaenium macranthum, *A. W. Hill* in *Kew Bull.* 1908, 339.
Naraguta, open grass land, 22 July, herb 6 ins. high, flowers pale apricot, sepals keeled, No. 463.

Distrib.—East Africa and Angola.

Neurotheca loeselioides, *Oliv.;* F.T.A. iv. i. 560.
Naraguta, in watery soil over rock slopes, 8 Aug., 1–3 ins. high, flowers blue, No. 530.

Distrib.—Upper Guinea to Gaboon and in Uganda.

Boraginaceae.

Heliotropium ovalifolium, *Forsk.;* F.T.A. iv. ii. 34.
Mamu, 2500 ft., 11 May; small white flowers in recurved spike, No. 164.

Heliotropium indicum, *Linn.;* F.T.A. iv. ii. 37; Holland, 472.
Lemme, 7 May, robust plant up to 2 ft., flowers heliotrope, No. 151.

Heliotropium strigosum, *Willd.;* F.T.A. iv. ii. 41.
Lemme, 2600 ft., 7 May, on farms up to 1 ft., flowers white, No. 124.
Bichikki, 2200 ft., 17 May, No. 184.

Trichodesma africanum, *R. Br.;* F.T.A. iv. ii. 48; Holland, 472.
Bauchi, 2200 ft., 13 May, corolla white, recurved, shiny brown spot at base of lobes, No. 169.

Distrib.—Cape Verde Islands to Abyssinia and in Angola.

Convolvulaceae.

Evolvulus alsinoides, *Linn.;* F.T.A. iv. ii. 67; Holland, 473.
Baradau, 3000 ft., 3 May, flowers bright blue, decumbent and spreading on hard soils, No. 89.

Convolvulus sagittatus, var. **abyssinica,** *Hallier* f.; F.T.A. iv. ii. 96.
Plains between Hepham and Ropp, 4600 ft., 5 July; decumbent 2–3 ft., flowers mauve, No. 362.

Ipomoea blepharophylla, *Hallier f.;* F.T.A. iv. ii. 141.
Naraguta, 20 June, creeper 1–3 ft., leaves rough, corolla mauve, with darker throat, No. 311.
Mongu, 4300 ft., 8 July; creeping 2 ft., stem brown, mauve flower with long calyx, No. 392.

Distrib.—Gold Coast to Jurland and in Angola.

Ipomoea involucrata, *Beauv.;* F.T.A. iv. ii. 150; Holland, 480.
Naraguta, 8 Aug., trailing over stones 4–6 ft., flowers mauve, 1–2 ins. in diam., only one flower out at a time from amongst a number, No. 514.

Ipomoea fragilis, *Choisy;* F.T.A. iv. ii. 165.
Naraguta, roadsides, decumbent, flowers yellow, No. 7.

Ipomoea Barteri, *Baker;* F.T.A. iv. ii. 169.
Mongu, 4300 ft., 8 July, climbing 2 ft., flowers 2 ins. in diam., pale pink, No. 391.
Distrib.—Confined in its typical form to Northern Nigeria.

Ipomoea aquatica, *Forsk.;* F.T.A. iv. ii. 170; Holland, 474.
Lemme, 2600 ft., 7 May, flowers large, purple, No. 143.
Panyam, 4500 ft., 11 July, 3–4 ft., flowers 2 ins. in diam., purple, No. 414.

Solanaceae.

Solanum torvum, *Swartz;* F.T.A. iv. ii. 231.
Jos, 22 June; 2–3 ft., flowers mauve, No. 316.
Distrib.—South to Angola.

Solanum duplosinuatum, var. **semiglabrum,** *C. H. Wright;* F.T.A. iv. ii. 244; Holland, 482.
Baradau, 3000 ft., 3 May, 2 ft. high, flowers mauve, No. 91.
Distrib.—Collected in Nupe by Barter, who states it is cultivated for its yellow fruit about the size of a tomato.

Schwenkia americana, *Linn.;* F.T.A. iv. ii. 260; Holland 505.
Jira, 2 May, 18 ins. flowers greeny brown, No. 130.

Scrophulariaceae.

Dopatrium longidens, *Skan* in F.T.A. iv. ii. 325.
Naraguta, 8 Aug., a herb 6 ins. high, growing in masses in shallow rock pools, flowers bright mauve and white, very ornamental, No. 526.
This beautiful little aquatic plant would be an acquisition for growing in warm water tanks in our greenhouses and we hope Mr. Lely will be able to send a supply of seeds. He is the first collector to find it since the type specimen was discovered long ago by Barter in Nupe. Both collectors speak of the highly ornamental character of the species. According to Barter it grows on rocks in pools after rains; flowers reddish purple, lip of corolla with a white spot, large for the size of the plant.

Lindernia nummulariaefolia, *Wettst.;* F.T.A. iv. ii. 341.
Naraguta, 8 Aug., tiny herb, 3–5 ins. high, flowers mauve and white, No. 518.

Ilysanthes gracilis, *Skan* in F.T.A. iv. ii. 349.
Naraguta, 8 Aug., a delicate little herb about 3–4 ins. high, with square stems and pink and white flowers, No. 519.
Distrib.—This and the next have not been gathered in Northern Nigeria since first discovered by Barter. Chevalier records *I. gracilis* from Fouta Djalon and the Ivory Coast and *I. Barteri* from the Koulikoro district in the French Sudan.

Ilysanthes Barteri, *Skan* l.c. 350.
Naraguta, 8 Aug., minute little herb, 2–4 ins., flowers bright blue, No. 520.

Scoparia dulcis, *Linn.;* F.T.A. iv. ii. 354; Holland, 506.
Naraguta, 12 ins., flowers pale mauve, No. 33.

Alectra senegalensis, *Benth.;* F.T.A. iv. ii. 371.
Naraguta, 8 Aug., a small herb amongst stones, uncommon, flowers yellow, No. 502.
Distrib.—Senegambia to Nyasaland.

Striga orobanchoides, *Benth.;* F.T.A. iv. ii. 402.
Naraguta, 5 Aug., in rock crevices near water, 9 ins. high, large root, tough stems, flowers pink, Hausa "Tokan Dawa," No. 489.
Distrib.—Wide; parasite on roots of *Indigofera* and other plants. According to Dalziel (Herb. Kew) very common in fields of millet, etc:

Striga aspera, *Benth.;* F.T.A. iv. ii. 403.
Naraguta, 20 June; slender spikes of bright pink flowers, No. 278.
Distrib.—Senegambia to Kenya Colony.

Striga strictissima, *Skan;* F.T.A. iv. ii. 407.
Lemme, 2600 ft., 7 May, 1½–2 ft., flowers pink, No. 146.
Distrib.—A rare species collected by Barter in Nupe, and probably occurring also in Djurland.

Striga lutea, *Lour.;* F.T.A. iv. ii. 409.
Naraguta, 8 Aug., herb 6–8 ins. high, in rock cracks and gravel over rock, flowers yellow, No. 525.
Neill's Valley, Naraguta, 15 June; 6–8 ins. high, flowers scarlet with green centre, No. 254.
The flowers of this species vary from scarlet to yellow or white.

Striga Forbesii, *Benth.;* F.T.A. iv. ii. 410.
Neill's Valley, 2 miles east of Naraguta Government Station, 15 June; 6 ins. high, corolla salmon pink, No. 255.

Sopubia ramosa, *Hochst.;* F.T.A. iv. ii. 449.
Naraguta, in grass country, 20 Aug., brittle stemmed herb, about 18 ins., flowers small, pink, No. 545.

Sopubia simplex, *Hochst.;* F.T.A. iv. ii. 450.
Naraguta, 1–2 ft., flowers pink, No. 23; flowers purple, No. 38.

Sopubia parviflora, *Engl.;* F.T.A. iv. ii. 452.
Naraguta, 8 Aug., in damp soil over rock, herb about 1 ft. high, flower yellow with purple centre, No. 524.
Distrib.—Djurland and Angola.

Lentibulariaceae.

Utricularia tribracteata, *Hochst.;* F.T.A. iv. ii. 475.
Naraguta, 8 Aug., minute herb about 2 ins. high with delicate mauve flowers, No. 521.
Distrib.—Also in Abyssinia and Somaliland; collected also by Dalziel near Lokoja (No. 133) and Yola (134).

Utricularia micropetala, *Smith;* F.T.A. iv. ii. 483.

Naraguta, 27 Aug., a small yellow herb 4–5 ins. growing on wet rocks, flowers yellow, No. 553.

Distrib.—Hitherto only known from Sierra Leone.

Utricularia subulata, *Linn.;* F.T.A. iv. ii. 485.

Naraguta, 8 Aug., minute herb 1–2 ins., flowers yellow, No. 522.

Utricularia rigida, *Benj.;* F.T.A. iv. ii. 487.

Naraguta, 27 August; a small herb about 2 ins. high with white flowers growing on flat rocks in running water, No. 555.

Distrib.—Sierra Leone to Nigeria.

This is referred to *U. rigida* with some reserve owing to the somewhat different aspect of the original plant, which presents a stouter flowering scape and somewhat more robust vegetative branches. Fruiting specimens, however, collected by Barter on Sugarloaf Mountain near Freetown, Sierra Leone, connect the two forms in a way suggesting ecological differentiation rather than genetic. Samples collected by Chevalier between Yinba and Kouria in French Guinea represent exactly the same condition as Mr. Lely's. The latter describes the flowers as white. In the dry state as received they are decidedly yellow and this colour becomes more pronounced on boiling.

U. rigida is an isolated type among the African species of *Utricularia* as far as they are known, and approaches most closely the Brasilian *U. neottioides*. It has no bladders and the plants are attached by hapters to the rocks or boulders of swift streams or cataracts.—(O. Stapf.)

Pedalineae.

Ceratotheca sesamoides, *Endl.;* F.T.A. iv. ii. 563.

Mamu, 2500 ft., 11 May, ½–2 ft.. flowers mauve, white inside with longitudinal purple lines, No. 162.

Naraguta, 26 July, No. 465.

Acanthaceae.

Hygrophila spinosa, *T. Ands.;* F.T.A. v. 31.

Naraguta, No. 30; 6 Aug., 2–3 ft., flowers purple, No. 500.

Brillantaisia Lamium, *Benth.;* F.T.A. v. 38.

Naraguta, 29 July, on roadsides, herb about 18 ins., corolla a deep rich purple, with two white patches on each side of base of lower petal, No. 469.

Dyschoriste radicans, *Nees;* F.T.A. v. 73.

Naraguta, 3 Aug., in clumps by the roadside, herb about 1 ft. high, flowers mauve, No. 483; flowers blue-purple, 20 Aug., No. 548.

Lepidagathis mollis, *T. Ands.;* F.T.A. v. 126.

Plains between Hepham and Ropp, 4600 ft., 5 July, 1–2 ft., bracts and sepals pale green, flowers white, No. 377.

Distrib.—Northern Nigeria and Uganda.

Asystasia coromandeliana, *Nees;* F.T.A. v. 131.
Jos, 26 June, 1–2½ ft., flowers mauve and white, No. 314.
Mongu, 4300 ft., 10 July, trailing or upright, 3–4 ft., flowers mauve, with purple throat, No. 402.

Justicia Galeopsis, *T. Ands.;* F.T.A. v. 196.
Pankshin, 5100 ft., 14 July; 1–1½ ft., stem ribbed, flowers bright pink, upper lip paler, No. 432.
Distrib.—North Tropical Africa.

Monechma hispidum, *Hochst.;* F.T.A. v. 213.
Plains between Bukuru and Hepham, 4300 ft., 4 July; 18 ins. high, lower lip of corolla cream white with orange lines on raised throat, upper lip blotched with dark green, No. 349.
Distrib.—North and East Tropical Africa.

Monechma depauperatum, *C. B. Clarke;* F.T.A. v. 217.
Panyam, 4500 ft., 11 July, 1 ft. high, bracts pale green with dark green midrib, corolla white, lower lip with purple lines across raised portions of throat, No. 409.
Distrib.—Sierra Leone to Lagos and Northern Nigeria.

Verbenaceae.

Lantana Camara, *Linn.;* F.T.A. v. 275.
Naraguta, 20 Aug., shrub about 5 ft. high amongst rocks, flowers orange, No. 547.

Lantana salvifolia, *Jacq.;* F.T.A. v. 276.
Pankshin, 5100 ft., 2–3 ft. high, flowers pale mauve, No. 431.

Lantana trifolia, *Linn.;* F.T.A. v. 277.
Nabardo, 2300 ft., 20 May; 1½–2 ft. high, leaves either two or three at a node, flowers cerise coloured, No. 213.

Stachytarpheta angustifolia, *Vahl;* F.T.A. v. 284.
Lemme 2600 ft. 7 May, 18 ins. high, flowers mauve, No. 142.
Distrib.—North and West Tropical Africa and in Tropical America.

Peristrophe pilosa, *Turrill,* sp. nov.; affinis *P. bicalyculatae,* Nees, sed caulibus pilis longis patulis instructis, inflorescentiis valde reductis vix 1·5 cm. longis in foliorum axillis differt.

Herba erecta, ramosa, caulibus 6-angularibus longitudinaliter striatis pilis albis distinctis patulis 2–3 mm. longis instructis. *Folia* elliptica, lanceolata vel elliptico-lanceolata, apice attenuato-acuminata, basi subacuta, lamina 7 cm. longa et usque ad 2·7 cm. lata, costa nervisque in pagina utraque prominentibus, nervis lateralibus utrinque circiter 6, pilis albis distinctis in pagina utraque praecipue in nervis praedita; petiolus 1–1·5 cm. longus, patule pilosus. *Inflorescentiae* axillares, 3–4-florae, 1·5 cm. longae; spiculae uniflorae; bracteae lineares, acuminatae, 1·2 cm. longae, marginibus dorsoque asperulis; bracteolae lineari-lanceolatae, acutissime acuminatae, 7 mm. longae, dorso leviter asperulae. *Calycis* segmenta 5, lineari-lanceolata, acu-

minata, 4 mm. longa, ciliata. *Corolla* circiter 1 cm. longa, superne extra piloso-pubescens. *Stamina* dua, filamentis leviter pubescentibus 4 mm. longis, antheris 1·5 mm. longis bilocularibus loculis rotundatis superpositis; pollinis granula ellipsoidea, 40μ longa, 28μ diametro. *Ovarium* 1·5 mm. longum, 0·75 mm. diametro; stylus 7·5 mm. longus, glaber.

NORTHERN NIGERIA. Panyam, 4500 ft., 11 July 1921, 2 ft. high, small pink flowers, *H. V. Lely* No. 415.

Clerodendron capitatum, *Sch. & Thonn.*; F.T.A. v. 305.

Pankshin, 5100 ft., 14 July; 2 ft. high, corolla white, 3 ins. long, No. 435.

Naraguta, 5 Aug., 10–12 ft. high, in thickets amongst rocks, flowers white and sweet-scented, No. 497.

Clerodendron Lelyi, *Hutchinson*, sp. nov.; affinis *C. myricoidei*, R. Br., a forma typica abyssinica caulibus simplicibus crassis (vix lignosis), foliis elongato-oblongo-oblanceolatis multo majoribus pedicellis haud elongatis differt.

Caules simplices, acute angulati, basin versus circiter 6 mm. crassi, scabrido-hispiduli. *Folia* ternatim verticillata, sessilia, elliptico-oblanceolata, apice plus minusve triangularia, cartilagineo-mucronata, basi late obtusa, 8–10 cm. longa, 1·5–4 cm. lata, rigide chartacea, remote crenato-serrata, utrinque laxe setuloso-scabrida; nervi laterales utrinsecus circiter 5, secondariis paucis. *Panicula* foliata, pyramidalis, circiter 18 cm. longa; rami laterales inferiores cymosi, circiter 6 cm. longi, foliis subnormalibus subtendentes; pedicelli ultimi 2 mm. longi, glabri; bracteolae subulatae, 2–3 mm. longae, puberulae. *Calyx* late turbinatus, 3 mm. longus, parce puberulus, lobis triangulari-rotundatis ciliolatis. *Corolla* alba et coerulea, circiter 1·5 cm. longa; tubus glaber, lobis rotundatis crebre ciliolatis. *Stamina* longe exserta, filamentis basi villosis, antheris 2 mm. longis. *Stylus* gracilis, glaber, apice bilobatus. *Fructus* immaturus inaequaliter bilobatus, sicco niger, glaber.

NORTHERN NIGERIA. Mongu, 4300 ft., 8 July, 1921, stems 2 ft. high, lower corolla lobe pale mauve, the others white, *H. V. Lely* No. 384.

LABIATAE.

Ocimum knyanum, *Vatke*, var. **astephanum,** *Baker* in F.T.A. v. 346.

Naraguta, 1–3 ft., flowers purple, No. 16.

Platystoma africanum, *P. Beauv.*; F.T.A. v. 349.

Naraguta, 2 Aug., roadsides and grass lands or rocks, herb about 1 ft. high, flowers pale blue, odour of sage, No. 479; 17 Aug., flowers white, No. 539.

Geniosporum paludosum, *Baker*; F.T.A. v. 352.

Plain between Bukuru and Hepham, 4300 ft., 4 July, 2–3 ft. high, bracts and flowers white, mint odour, No. 345.

Distrib.—East Tropical Africa.

Acrocephalus alboviridis, *Hutchinson*, sp. nov., caulibus sicco nigro-purpureis glabris foliis oblongo-ovatis glabris capitulis sphaericis alboviridibus distincta.

Planta lignosa usque ad 1·3 m. alta, superne corymboso-ramosa; caulis obscure quadrangularis, basin versus circiter 6 mm. diametro, internodiis circiter 2 cm. longis. *Folia* sessilia, oblongo-ovata, acuta vel acute acuminata, 2–4 cm. longa, 0·7–1·7 cm. lata, rigide coriacea, serrato-crenata, glabra, nervis lateralibus obscuris. *Capitula* sphaerica, alboviridia, dense corymboso-conferta, circiter 1·5 cm. longa, dense villoso-tomentosa; bracteae dense confertae, late obovato-orbiculares, apice breviter triangulares, circiter 1 cm. longae et 1·2 cm. latae, extra superne dense villoso-tomentosae, intra glabrae. *Calyx* dentatus, extra dense villosus, intra glaber. *Corolla* infundibuliformis, 6 mm. longa, fere glabra, lobis ovatis obtusis. *Stamina* exserta; filamenta circiter 6 mm. longa, glabra; antherae 0·75 mm. longae. *Stylus* staminibus paullo brevior, bifidus. *Ovarium* glabrum.

Northern Nigeria. Ropp, 4600 ft., 19 July, 1921, 3–4 ft. high, spherical greenish white heads with pale mauve flowers, *H. V. Lely* No. 456.

Orthosiphon salagensis, *Baker*; F.T.A. v. 368.

Bichikki, 2200 ft., 17 May, 15 ins. high, spikes of reddish purple flowers with odour of sage, No. 186.

Distrib.—Gold Coast and Northern Nigeria.

Orthosiphon bracteosus, *Baker*; F.T.A. v. 375.

Naraguta, 18 ins., bracts purple, flowers white with purple veins, No. 47.

Distrib.—Upper Guinea and East Africa, south to Nyassaland.

Hoslundia opposita, *Vahl*, var. **verticillata,** *Baker*; F.T.A. v. 377.

Top of Zaranda Mt., 5800 ft., 18 May, upright 2–4 ft. high, flowers greenish white, No. 192.

Aeolanthus pubescens, *Benth.*; F.T.A. v. 394.

Naraguta, 5 Aug., herb about 1–2 ft., with strong balsamiferous odour, flowers pale blue, No. 494.

Distrib.—Endemic to Nigeria north of Abeokuta.

Solenostemon ocymoides, *Sch. & Thonn.*; F.T.A. v. 420.

Vodni, 4600 ft., 13 July, 1½–2 ft., flowers bright red purple, No. 420. Naraguta, 17 Aug., on farms, flowers pink, No. 540.

Hyptis pectinata, *Poit.*; F.T.A. v. 448.

Ringim Mukr, 2500 ft., 22 May, woody perennial 6–10 ft., flowers pale mauve, with sage odour, No. 219.

Naraguta, 20 Aug., about 6 ft., in open grass country, No. 551.

Hyptis suaveolens, *Poit.*; F.T.A. v. 449.

Bichikki, 2200 ft, a robust branching plant 3–4 ft high, on farms, flowers dark purple, strong mint-like odour, No. 183.

Introduced from Tropical America.

Leucas martinicensis, *R. Br.*; F.T.A., v. 479.
Naraguta, 1 Aug., herb. about 15 ins., globular whorls of white flowers, calyx prickly, No. 475.

Tinnaea aethiopica, *Kotschy & Peyr.*; F.T.A. v. 497.
Zelau, 3200 ft., 24 Apr., bush 8–10 ft., on stream banks, flowers a deep velvety red brown, almost black at tip of lower lip, No. 112.

Nyctaginaceae.

Boerhaavia adscendens, *Willd.*; F.T.A. vi. i. 4.
Baradau, 3000 ft., 2 ft. high, flowers pink, No. 86.

Boerhaavia repens, *Linn.*; F.T.A. vi. i. 4.
Mamu, 2500 ft., 11 May; 2 ft. high, minute pink flowers, Hausa "Babba juji," taken as a cure for faintness due to hunger, No. 167.

Amarantaceae.

Celosia laxa, *Sch. & Thonn.*; F.T.A. vi. i. 18.
Mongu, 4300 ft., 10 July, 2 ft. high, flowers pale pink, stamens bright pink, No. 403.

Celosia trigyna, *Linn.*; F.T.A. vi. i. 19.
Baradau, 3000 ft., 3 May, 12 ins. high, flowers white, No. 90.

Amaranthus spinosus, *Linn.*; F.T.A. vi. i. 32.
Takwara, 3200 ft., 14 May, stem thorny, 1 ft. high, flower spikes green, No. 102.

Amaranthus oleraceus, *Linn.*; F.T.A. vi. i. 34.
Mamu, 2500 ft., 11 May; 1–1½ ft., small clusters of red or mauve flowers, Hausa "Zakin Bamza," eaten as a vegetable, No. 166.

Pandiaka involucrata, *Moq.*; F.T.A. vi. 1. 67.
Naraguta, 4000 ft., 30 May, No. 239.
Distrib.—Gold Coast to Nigeria.

Alternanthera achyranthoides, *Hiern*; F.T.A. vi. i. 73.
Naraguta, trailing in stream bed, No. 29. Lemme, 2600 ft. 18 ins. long, clusters of green white flowers, No. 145.

Polygonaceae.

Polygonum serrulatum, *Lag.*; F.T.A. vi. i. 107.
Zaranda Filani, 19 May, in marshes, 3–4½ ft high, flowers pink. No. 200. Plains between Hepham and Ropp, 4600 ft., 5 July, 1–2 ft, flowers red, No. 365. Pankshin, 5100 ft., 14 July, in marshes, 2 ft. high, flowers red, No. 430.

Polygonum lanigerum, *R. Br.*; F.T.A. vi. i. 109.
Naraguta, 23 June, damp places in masses, 5–6 ft., whole plant silvery, flowers white, No. 323.

Polygonum senegalense, *Meisn.*; F.T.A. vi. i. 111.
Tilde Filani, 3300 ft., 24 May, 2–3 ft. high in river bed, flowers white, No. 226.

Rumex abyssinicus, *Jacq.*; F.T.A. vi. i. 114.
Plains between Hepham and Ropp, 4600 ft., 5 July, 2–5 ft., No. 367.

Proteaceae.

Protea argyrophaea, *Hutchinson*, sp. nov.; affinis *P. Elliottii*, C. H. Wright, sed foliis multo angustioribus capitulis minoribus, perianthii limbo libero superne glabro differt.

Planta lignosa 0·6–1·3 m. alta; rami laxe foliati, flexuosi, purpurei, glabri, demum leviter verrucosi. *Folia* sessilia, oblique lanceolata vel anguste lanceolata, subacuta, basi cuneata, 7–15 cm. longa, 1·5–4 cm. lata, rigide coriacea, glabra, utrinque laxe reticulata; nervi laterales utrinsecus circiter 10, prominuli,

Fig. 10. *Protea argyrophaea*, Hutchinson. 1, leaf; 2, trifid perianth-limb; 3, free perianth-limb; 4, anther; 5, pistil.

marginem versus multe ramosi, linea intramarginalem formantes. *Capitula* terminalia, solitaria, circiter 6 cm. longa et 5 cm. diametro. *Involucri bracteae* 9–10 -seriatae, exteriores parvae, ovato-triangulares, circiter 3 mm. longae, intermediae late oblongo-ovatae, 3 cm. longae, parce appresse lanatae, interiores spathulato-oblongae, fere 6 cm. longae, apice rotundatae et ciliatae, dorso appresse sericeae. *Flores* albi. *Perianthium* 4 cm. longum, ad basin bipartitum, segmentis 3 connatis, limbo 1·3 cm.

longo apice trilobato, lobis lateralibus molliter pilosis intermediis glabris, segmento libero limbo lineari-lanceolato acuto superne glabro. *Antherae* circiter 6 mm. longae. *Ovarium* dense ferrugineo-villosum, stylo 3·5 cm. longo glabro 5 mm. infra apicem minute geniculato.

NORTHERN NIGERIA. Plains between Hepham and Ropp, 4600 ft., 5 July, 1921, 2–4 ft. high, flowers white, odour very strong, *H. V. Lely* No. 381.

The specific name refers to the silvery sheen on the intermediate bracts, which is conspicuous according to the amount and direction of light.

THYMELAEACEAE.

Gnidia Schweinfurthii, *Gilg ;* F.T.A. vi. i. 219.

Naraguta, 18 ins. high, flowers yellow, No. 76.

Distrib.—Northern Nigeria to Bongoland.

Lasiosiphon Kraussii, *Meisn. ;* F.T.A. vi. i. 231.

Naraguta, 1 ft. high, flowers yellow, Nos. 11 and 13.

Arthrosolen chrysantha, *Solms.-Laub. ;* F.T.A. vi. i. 234.

Naraguta, 12 ins. high, flowers yellow, No. 79.

Distrib.—From Northern Nigeria southwards over nearly all Tropical Africa.

LORANTHACEAE.

Loranthus dodoneaefolius, *DC. ;* F.T.A. vi. i. 341.

Naraguta, 5 Aug., a parasite 2–3 ft. high on *Parkia filicoidea*, flowers deep red, No. 498.

Distrib.—Senegambia to Uganda.

SANTALACEAE.

Thesium leucanthum, *Gilg ;* F.T.A. vi. i. 420.

Naraguta, 18 ins. high, flowers yellow, No. 66.

Distrib.—Hitherto known only from Angola; a very distinct species with remarkably long perianth; the plants from the two areas do not seem to be separable.

Thesium viride, *A. W. Hill,* var. **pubescens,** *Hutch.* in *Kew Bull.* 1921, 253.

Naraguta, in clumps 8 ins. high, flowers brown or yellow, No. 5.

Distrib.—Type form also in the Cameroons.

EUPHORBIACEAE.

Euphorbia convolvuloides, *Hochst. ;* F.T.A. vi. i. 495.

Rinjim Mukr, 2500 ft., 6–12 ins. high, minute red flowers, No. 222.

Distrib.—North and East Tropical Africa.

Euphorbia hirta, *Linn. ;* F.T.A. vi. i. 496.

Naraguta, 6 ins. high, flowers green, No. 34.

Euphorbia hypericifolia, *Linn.*; F.T.A. vi. i. 498.
Takwara, 3200 ft., 4 May, 6 ins. high, minute red flowers, No. 115.

Phyllanthus capillaris, *Schum. & Thonn.*; F.T.A. vi. i. 709.
Plains between Hepham and Ropp, 4600 ft., 5 July, 3 ft. high, woody, flowers white, minute, No. 371.

Phyllanthus pentandrus, *Schum. & Thonn.*; F.T.A. vi. i. 710.
Lemme, 2600 ft., 7 May, 12 ins. high, minute green flowers, No. 139.

Fluggea microcarpa, *Bl.*; F.T.A. vi. i. 736.
Panyam, 4500 ft., 11 July, 3 ft. high, greenish white flowers, No. 418.

Croton lobatus *Linn*; F.T.A. vi, i. 750.
Lemme, 2600 ft., 7 May, 1–2 ft. high, petals minute, pale pink, No. 134. Vodni, 4600 ft. 13th July, No 429.

Chrozophora senegalensis, *A. Juss*; F.T.A. vi, i. 837.
Lemme, 2600 ft., 7 May, 6–12 ins. high, flowers minute, red, No. 133.
Distrib.—Upper Guinea to North Central Africa.

Acalypha senensis, *Klotzsch*, var. **chariensis,** *Hutch.*; F.T.A. vi. i. 889.
Panyam, 4500 ft., 17 July, 2 ft. high, male flower with pink calyx and white stamens, female with 3 bright red hairy styles, No. 412.

Acalypha ornata, *Hochst.*; F.T.A. vi. i. 890.
Tilde Filani, 3300 ft., 24 May, 6–8 ft. high, spikes of reddish flowers in sticky bracts, No. 230.

Acalypha crenata, *Hochst.*; F.T.A. vi. i. 903.
Nabardo, 2300 ft., 20 May, No. 214.
Distrib.—N. Nigeria to Abyssinia and Somaliland.

Tragia spathulata, *Benth.*; F.T.A. vi. i. 971.
Neill's Valley, 2 miles east of Naraguta Government Station, 15 June, climbing, in tangled masses, with stinging hairs, flowers greenish, No. 265.
Distrib.—Upper Guinea.

Urticaceae.

Trema guineensis, *Ficalho*; F.T.A.
Naraguta, 4000 ft., 30 June, woody, 2 ft. high, flowers and fruits green, No. 340.

Hydrocharidaceae.

Ottelia lancifolia, *A. Rich.*; F.T.A. vii. 7.
Naraguta, 8 Aug., an aquatic in mud on bottom of small pools in running water, whole plant sometimes blooming entirely under water, sometimes the corolla on the surface, flowers yellow, No. 509.

Orchidaceae.

Eulophia guineensis, *Lindl.*; F.T.A. vii. 69.

Tilde Filani, 3300 ft., on stream bank in dark places, 24 May, 2–3 ft. high, sepals greenish-purple, lip pale mauve, No. 232.

Distrib.—North and West Tropical Africa.

Eulophia propinqua, *Hutchinson*, sp. nov., affinis *E. Shupangae*, Kränzl., sed foliis angustioribus bracteis brevioribus, labelli lobo medio minore et integro differt.

Herba erecta, 0·75 m. alta. *Folia* elongato-lineari-lanceolata, acuta, basin versus longe attenuata, usque ad 45 cm. longa, circiter 1 cm. lata, multinervia, glabra. *Scapi* elongati, vaginis 4 cm. distantibus striatis stramineis dense induti; racemi 4–5 cm. longi, circiter 12–15-flori; bracteae lineari-lanceolatae ad ovato-lanceolatae, acute acuminatae, inferiores 2 cm. superiores 0·5 cm. longae, fere membranaceae, glabrae; pedicelli ad 7 mm. longi. *Flores* flavi, purpureo striati, labio rubro maculati. *Sepala* et petala subaequalia, ovato-lanceolata, acuta, circiter 1 cm. longa et 6–7 mm. lata, striata. *Labellum* 8 mm. longum, 5 mm. latum, trilobum, lobis lateralibus oblongo-lanceolatis apice rotundatis 2–3 mm. longis, intermedio late oblongo apice rotundato 4·5 mm. longo supra dense et acute verrucoso. *Calcar* distinctum, 1·25 mm. longum. *Columna* 6 mm. longa, oblongo-linearia.

Northern Nigeria. Plains between Hepham and Ropp, 4600 ft., 5 July, bright yellow terrestrial orchid 2 ft., "hood" with purple lines, lip spotted red, *H. V. Lely* No. 353.

Superficially this new species closely resembles the genus *Pteroglossaspis*, but the presence of a short spur excludes it from this genus. Its affinity in *Eulophia* is clearly with *E. Shupangae*, Kränzl., an East Tropical African species, from which it differs in the characters noted in the description above.

Lissochilus Heudelotii, *Reichb. f.*; F.T.A. vii. 80.

Naraguta, 4 ft. high, lip deep purple with green wings, remainder of the flower pale mauve pink, No. 81.

Distrib.—Senegambia to Northern Nigeria.

Lissochilus arenarius, *Lindl.*; F.T.A. vii. 82.

Zaranda Filani, 19 May, flowers pale purple, No. 199.

Angraecum Kotschyanum, *Reichb. f.*; F.T.A. vii. 137.

Neill's Valley, 2 miles east of the Government Station, Naraguta, 15 June, growing on *Ficus* and *Diospyros*, racemes 3, the longest 22 inches in the axil of the lowermost leaf, the other two from below the leaves, spur 9–10 inches long, flesh pink, flowers white, No. 272.

Distrib.—This is the first gathering from Upper Guinea; recorded previously from East Tropical Africa, from Senaar to the River Shire, Nyasaland.

Pogonia umbrosa, *Rchb. f.;* F.T.A. vii. 186.

Zelau, 3200 ft., 25 Apr., root tuberous, flowers green with 2 purple lines inside the lip, No. 117.

Distrib.—West Trop. Africa from Sierra Leone to Angola.

Satyrium nigericum, *Hutchinson*, sp. nov.; affinis *S. Carsoni*, Rolfe, sed inflorescentia densiflora, floribus minoribus, calcaribus brevioribus differt.

Herba terrestris, erecta, circiter 35 cm. alta. *Folia* basalia geminata, patula, orbiculata, circiter 3 cm. longa et fere 5 cm. lata, tenuiter chartacea, multinervia, glabra; folia caulina ad vaginas 3·5–4 cm. longas reducta. *Inflorescentia* 4–5 cm. longa, densiflora, conspicue bracteata; bracteae obovatae, apice rotundatae, 1·5–2 cm. longae, usque ad 1·3 cm. latae, fere membranaceae, circiter 10-nerviae, glabrae. *Flores* albi. *Sepala* circiter 1 cm. longa, dorsale oblanceolato apice rotundato 2 mm. lato, lateralibus oblique oblongo-ellipticis late emarginato 4 mm. latis. *Petala* sepalo dorsale similia. *Labellum* superum, 1 cm. longum, cucullatum, supra carinatum, in calcaribus duobus subacutis circiter 7 mm. longis productum. *Columna* curvata, 5 mm. longa, apice complanato-rotundata. *Ovarium* alatum, 5–7 mm. longum.

Northern Nigeria. Plain between Bukuru and Hepham, 4300 ft., 4 July, 1921, flowers pure white, with double spurs, ovary winged, *H. V. Lely* No. 344.

Brachycorythis pubescens, *Harv.;* F.T.A. vii. 201.

Naraguta, 4000 ft., 30 May, 2 ft. high, spikes 1 ft. long, flowers purple, No. 237.

Distrib.—Hitherto unknown from Upper Guinea; previously recorded from Kenya Colony to the Transvaal and Natal and in Angola.

Habenaria zambesina, *Reichb. f.;* F.T.A. vii. 211.

Mongu, 4300 ft., 10 July, spike 3–4 inch, flowers white, No. 405.

Naraguta, in grass of open park country, 22 July. Hausa name "Rumana," No. 461.

Habenaria Mannii, *Hk. f.;* F.T.A. vii. 225.

Naraguta and Jos, 4 Sept., handsome green terrestrial orchid about 15 ins. high, No. 560.

Distrib.—Known hitherto only from the Cameroon Mt., where it occurs between 5000–9000 ft. altitude; the bracts of the Nigerian specimen are rather larger and the plant more robust than the Cameroon examples, but I do not think there is a specific difference.

Scitamineae.

Cadalvena Dalzielii, *C. H. Wright* in *Kew Bull.* 1912, 195.

Top of Zaranda Mt., in water course on slopes, 5800 ft., 18 May, leaves four, flower yellow to orange, No. 198;

common also in Zaria and in large numbers at Tilde Filani and Naraguta.

Distrib.—Apparently endemic; according to Dalziel it occurs all over Northern Nigeria except in the north; Hausa "Takalmin zomo" = hare's slipper. A very beautiful species worthy of cultivation.

Iridaceae.

Aristea angolensis, *Baker*; F.T.A. vii. 347.

Plains between Bukuru and Hepham, 4300 ft., 4 July, 1–2 ft. high, flowers bright blue, No. 342.

Distrib.—Known hitherto only from Angola.

Lapeyrousia montana, *Hutchinson*, sp. nov.; affinis *L. Sandersonii*, Baker, species transvaalensis, sed perianthii tubo multo breviore differt.

Herba glabra, circiter 30 cm. lata, superne laxe ramosa; caulis sulcatus, flexuosus, basin versus circiter 2·5 mm. crassus. *Folia* pauca (2–3), linearia, acuta, 10–15 cm. longa, 1·5–2·5 mm. lata, rigida, trinervia. *Inflorescentia* laxe cymosa, ramis paucifloris flexuosis; bracteae lanceolato-ovatae, acutae, circiter 7 mm. longae, membranaceae, apicem versus coloratae. *Perianthium* coeruleum; tubus 1 cm. longus, inferne cylindricus, superne sensim expansus; lobi unguiculati, oblanceolati, acute apiculati, 1 cm. longi, circiter 4 mm. lati, striati. *Stamina* perianthii segmentis breviora; filamenta 4 mm. longa; antherae 4 mm. longae, obtusae. *Stylus* staminibus paullo longior, ramis 1·75 mm. longis apice bifidis. *Ovarium* late ellipsoideum, 2·5 mm. longum.

Northern Nigeria. Top of Zaranda Mt., 5800 ft., 18 May, 1921, 1–1½ ft. high, flowers blue, with dark purple spot at base of tube, *H. V. Lely* No. 189. Neill's Valley, 2 miles east of Government Station, Naraguta, June 15, No. 271.

Gladiolus spicatus, *Klatt.*; F.T.A. vii. 369.

Plains between Hepham and Ropp, 4600 ft., 5 July, 9–24 ins. high, flowers red-purple, No. 357.

Distrib.—Endemic to Northern Nigeria.

Gladiolus Quartinianus, *A. Rich.*; F.T.A. vii. 371.

Neill's Valley, 2 miles east of Naraguta Government Station, rocky places, 15 June, flowers orange spotted and streaked, No. 256. Naraguta, 4000 ft., open grass country, 30 May, flowers yellow green, No. 244; this number probably represents the form described by Baker as *G. primulinus*, later merged by him in *G. Quartinianus*.

Gladiolus unguiculatus, *Baker*; F.T.A. vii. 372.

Baradau, 3000 ft., 3 May, 2–3 ft. high, flowers pink and white, No. 97.

Distrib.—Sierra Leone to Eastern Sudan and Nyasaland.

Hypoxis angustifolia, *Lam.*; F.T.A. vii. 378; Nel in Engl. Bot. Jahrb. lxi. 305.

Top of Zaranda Mt., 5800 ft., 18 May, flowers bright yellow, No. 193.

Crinum yuccaeflorum, *Salisb.*; F.T.A. vii. 399.

Bichikki, 2200 ft., 17 May, leaves 12–18 ins., perianth white with purple middle line, No. 182.

Nabardo, 20 May, No. 202.

Distrib.—West Tropical Africa.

Mr. Lely notes a difference in his plants numbered 182 and 202. The former he never found with more than 2 flowers in each head, the latter with 8 flowers, and a much more robust plant than No. 182. There is probably considerable variation in the number of flowers to each umbel.

Taccaceae.

Tacca pinnatifida, *Forst.*; F.T.A. vii. 413.

Nabardo, 2300 ft., 20 May, 3 ft. high, leaf appearing first, wrapped in a strong sheath about 8 ins. long, marked like a snake-skin pale green with brown purple pattern, the sheath completely cast off on maturity, flowers white, No. 209.

Dioscoreaceae.

Dioscorea Beccariana, *Martelli*; F.T.A. vii. 420.

Naraguta, 4000 ft., 30 May, climbing, No. 246.

Liliaceae.

Asparagus Pauli-Guilelmi, *Solms*; F.T.A. vii. 428.

Naraguta, flowers white, No. 12.

Zelau, 3200 ft., 25 Apr., 1–2 ft. high, No. 119.

Asparagus africanus, *Lam.*; F.T.A. vii. 433.

Nabardo, 2300 ft., 20 May, delicate small spined plant 1–3 ft. high with white flowers, No. 204.

Aloe Barteri, *Baker*; F.T.A. vii. 464.

Pankshin, 5100 ft., 14 July, 3 ft. high, leaves dark green with very occasional pale green spots, flowers pale brick red, No. 433.

Distrib.—Togoland to the Ubangui.

Anthericum triflorum, *Ait.*; F.T.A. vii. 493.

Neill's Valley, 2 miles east of the Government Station, Naraguta, 15 June, on rocks near water, flowers white, sweet-scented, No. 258.

Chlorophytum blepharophyllum, *Schweinf.*; F.T.A. vii. 501.

Zelau, 3200 ft., near streams, roots fleshy, not bulbous, 1 ft. high, flowers dull brown, No. 113.

Naraguta, 4000 ft., 30 May, No. 245.

Distrib.—North and East Tropical Africa.

Chlorophytum pusillum, *Schweinf.*; F.T.A. vii. 502.
Naraguta, 4000 ft., prostrate, forming a thick mat on the ground, flowers white, No. 248.
Distrib.—Also in Jurland.

Dipcadi longifolium, *Baker*; F.T.A. vii. 519.
Takwara, 3200 ft., 1–3 ft., flowers loose, green, No. 118.
Distrib.—Upper Guinea and South East Trop. Africa.

Urginia nigritana, *Baker*; F.T.A. vii. 542.
Bukuru, 20 July, 18 ins. high, flowers green, No. 460
Distrib.—Northern Nigeria to Uganda.

Gloriosa virescens, *Lindl.*; F.T.A. vii. 563.
Nabardo, 2300 ft., 20 May, near streams, 1–4 ft. high, perianth-segments dark red, edged with bright yellow, green at the base, No. 211.

Xyridaceae.

Xyris Barteri, *N. E. Brown*; F.T.A. viii. 22.
Naraguta, 20 June, boggy places, 6–9 ins. high, No. 282.
Distrib.—Northern Nigeria to the Upper Chari.

Commelinaceae.

Commelina nudiflora, *Linn.*; F.T.A. viii. 36.
Zelau, 3200 ft., 25 Apr., decumbent and upright in wet places, flowers blue, No. 116.

Aneilema sinicum, *Lindl.*; F.T.A. viii. 63.
Mongu, 4300 ft., 10 July, 1–2 ft. high, flowers violet, opening in the evening, No. 406.

Aneilema soudanicum, *C. B. Clarke*; F.T.A. viii. 71.
Lemme, 2600 ft., 1–2 ft. high, No. 138.
Distrib.—Nigeria and Cameroons to Abyssinia.

Cyanotis lanata, *Benth.*; F.T.A. viii. 80.
Naraguta, 20 June, 12 ins. high, succulent plant, leaves and stem with long tangled cottony hairs, petals mauve, filaments with purple hairs, No. 280.
Plains between Hepham and Ropp, 4600 ft., 5 July, No. 382.

Floscopa flavida, *C. B. Clarke*; F.T.A. viii. 87.
Naraguta, 27 Aug., tiny herb 2–3 ins. high growing on wet rocks, flowers mauve and cream, No. 554.
Distrib.—Also in Jurland, Nyasaland and at the Victoria Falls.

There are several more species of *Commelinaceae* in the collection which I have not been able to determine satisfactorily.

Araceae.

Amorphophallus Barteri, *N. E. Br.*; F.T.A. viii. 151.
Mamu, 2500 ft., 11 May, in dark crevices under overhanging rocks in rich soil, 1 ft. high, spathe dark purple, male

flowers brick-red, females green with purple stigma, pungent odour. Hausa name "Kunnen Jaki" (Donkey's ear), root supposed cure for delayed childbirth, No. 159.

Distrib.—Endemic to Northern Nigeria.

Cyperaceae.

Pycreus flavescens, *Reichb.*; F.T.A. viii. 290.
Naraguta, 4000 ft., 1 ft. high, No. 96.

This and most of the remainder of the Monocotyledons here enumerated are widely spread in Tropical Africa.

Cyperus compactus, *Lam.*; F.T.A. viii. 319.
Lemme, 2600 ft., 18 ins. high, white sweet scented sedge No. 148.

Cyperus amabilis, *Vahl*; F.T.A. viii. 327.
Naraguta, 4000 ft., 15 Apr., 1 ft. high, No. 95.

Cyperus Haspan, *Linn.*; F.T.A. viii. 332.
Lemme, 7 May, 2 ft. high, No. 154.

Cyperus distans, *Linn.*; F.T.A. viii. 349.
Naraguta, 23 June, 12–18 ins. high, No. 329.

Cyperus esculentus, *Linn.*; F.T.A. viii. 355.
Lemme, 2600 ft., 7 May, 12 ins. high, No. 149.

Cyperus exaltatus, var. **dives,** *Delile*; F.T.A. viii. 370.
Nabardo, 25th May, 4–6 ft. high, No. 203.

Mariscus umbellatus, *Vahl*; F.T.A. viii. 390.
Taura, 6 May, 18 ins. high, No. 123.
Jira, 2 May, No. 129.

Fimbristylis diphylla,; *Vahl* F.T.A. viii. 415.
Lemme, 7 May, 2½ ft. high, No. 153.

Fimbristylis monostachya, *Vahl*; F.T.A. viii. 424.
Rinjim Mukr, 2500 ft., 22 May, 6 ins. high, No. 221.

Fuirena umbellata, *Rotb.*; F.T.A. viii. 466.
Naraguta, 8 Aug., 2–3 ft., in grasslands, No. 516.

Lipocarpha albiceps, *Ridley*; F.T.A. viii. 471.
Baradau, 3000 ft., 3 May, 1 ft. high, heads white, No. 98.

Ascolepsis protea, var. **bellidiflora,** *Welw.*; F.T.A. viii. 474.
Panyam, 4500 ft., 11 July, 6–8 ins. high, flowers white, No. 411.

Eriospora pilosa, *Benth.*; F.T.A. viii. 512.
Top of Zaranda Mt., 18 May, No. 197.

Distrib.—Upper Guinea.

Gramineae.

Manisuris granularis, *Sw.*; F.T.A. ix. 57.
Naraguta, 1 Aug., 1–2 ft. high, local, No. 477.

Hypharrenia rufa, *Stapf*; F.T.A. ix. 304.
Naraguta, 20 June, No. 292.

Alloteropsis semialata, *Hitchc.*
Top. of Zaranda Mt., 5800 ft., 18 May, No. 195.

Brachiaria fulva, *Stapf.*; F.T.A. ix. 518.
Naraguta, 20 June, No. 289.

Paspalum scrobiculatum, var. **polystachyum,** *Stapf*; F.T.A. ix. 576.
Naraguta, 23 June, No. 332.

Sacciolepis interrupta, *Stapf*; F.T.A. ix. 757.
Naraguta, 23 June, No. 327.

Setaria aurea, *A. Br.*
Naraguta, 20 June, No. 291.

Setaria barbata, *Kunth.*
Naraguta, 21 June, No. 298.

Tricholaena rosea, *Nees.*
Naraguta, 21 June, No. 295.

Pennisetum polystachyum, *Kunth.*
Naraguta, 20 June, No. 290.

Sporobolus festivus, *Hochst.*
Naraguta, 21 June, No. 296.

Eragrostis megastachya, *Link.*
Naraguta, 20 June, No. 293.

Cynodon Dactylon, *Pers.*
Nabardo, 2300 ft., 20 May, No. 201.

Eleusine coracana, *Gaertn.*
Naraguta, 8 Aug., in grass lands, 2–3 ft., high, No. 515.

Filices.

Adiantum lunulatum, *Burm.*; Hook. & Bak. Synop. Fil. 114.
Naraguta, on river banks and amongst rocks, 15 June, No. 304.

Anemia Schimperiana, *Presl.*; Hook. & Bak. Synop. Fil. 434.
Naraguta, as above, No. 307.

Cheilanthes Schimperi, *Knze.*; Hook. & Bak. l.c. 133.
Naraguta, as above, No. 303.
Distrib.—East Africa from Abyssinia to Rhodesia.

Cheilanthes farinosa, *Kaulf.*; Hook. & Bak. l.c. 142.
Naraguta, as above, No. 305.

Nephrolepis cordifolia, *Presl.*; Hook. & Bak. l.c. 300.
Naraguta, as above Nos. 301 and 309.

Pellaea Doniana, *Hook.*; Hook. & Bak. l.c. 152.
Naraguta, as above No. 302.

XLVII.—MISCELLANEOUS NOTES.

William Purdom.—We regret to learn, through Mr. C. H. Hough, of Ambleside, that Mr. W. Purdom died suddenly at Pekin on November 7th, 1921. He will long be remembered as one of the intrepid band of collectors, including Henry, Wilson, Forrest, Farrer and Meyer, who explored China in the interests of botany and horticulture during the early years of the twentieth century. He was born at Heversham, in Westmorland, April 10th, 1880, and after several years' training at Brathay Hall Gardens, Messrs. Low & Sons, of Enfield, and Messrs. Veitch at Coombe Wood, came to Kew in August, 1902, leaving in December, 1908. He was then engaged by Messrs. Veitch and Harvard University as plant collector in China, chiefly in the province of Kansu. Subsequently he joined the late Mr. Reginald Farrer as travelling companion in the same region. Their joint adventures are recorded in Mr. Farrer's "Eaves of the World," and "The Rainbow Bridge." Mr. Farrer always wrote and spoke of Purdom in terms of admiration and affection, and he dedicated the first book to "my dear Bill"—an "absolutely perfect friend and "helper, through whom alone it was that these odysseys were "made possible and pleasant." In 1917 he was appointed to be head of one of the five Departments of Forestry maintained by the Chinese Government. During the last four years he has established nurseries in various parts of Honan in furtherance of large schemes of reafforestation in the north of China. He has also had much to do with the railways, and with the supply of timber from native sources.

Index Kewensis, Supplement V.*—The appearance of the fifth supplement to the Index Kewensis continues that work to the end of the year 1915. Compared with the three preceding quinquennial supplements, the one just issued exhibits a considerable increase in size, containing 277 pages as against 204, 193 and 252 respectively in the second, third and fourth supplements. The geographical distribution of new species is now given in greater detail; in the case of new combinations only the synonym is given. It may be well to call attention to the fact that this supplement—like the last—is a register of names without any reductions, no opinion being expressed as to the validity of the genera and species contained in it. Numerous names accidentally omitted from previous supplements are included, and others are re-inserted in cases where the reference originally given was not the earliest.

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* Index Kewensis Plantarum Phanerogamarum Supplementum Quintum nomina et synonyma omnium generum et specierum ab initio anni MDCCCCXI usque ad finem anni MDCCCCXV nonnulla etiam antea edita complectens ductu et consilio D. Prain confecerunt Herbarii Horti Regii Botanici Kewensis Curatores. Oxonii e prelo Clarendoniano MDCCCCXXI.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1921.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a select list of seeds of Hardy Herbaceous Plants and of Hardy Trees and Shrubs which, for the most part, have ripened at Kew during the year 1920. These seeds are available only for exchange with Botanic Gardens, as well as with regular correspondents of Kew.

HERBACEOUS PLANTS.

Abronia arenaria.
umbellata.

Acaena glaucophylla.
laevigata.
macrostemon.
microphylla.
Novae-Zelandiae.

Acanthus longifolius.
mollis.

Achillea argentea.
Clavennae.
decolorans.
grandiflora.
Kellereri.
macedonica.
macrophylla.
nana.

Achillea—*cont.*
odorata.
serbica.
sibirica.
Wilczekii.

Aconitum barbatum.
chinense.
columbianum.
lasianthum.
leptanthum.
moldavicum.
orientale.
uncinatum.
volubile.
Vulparia.
Wilsonii.

Actaea alba.
arguta.
spicata.

(1253.) Wt. 135—P. 47. 1,160. 12/20. J. T. & S., Ltd. G. 14. Sch. 12.

Adenophora ornata.

Adenostyles viridis.

Adlumia cirrhosa.

Aethionema amoenum.
cappadocicum.
pulchellum.

Agrostis alba.
elegans.

Allium grande.
kansuense.
karataviense.
macranthum.
neapolitanum.
odorum.
pulchellum.
roseum.
siculum.
sikkimense.
sphaerocephalum.

Alonsoa linifolia.
Warscewiczii.

Alstroemeria aurantiaca.
haemantha.
Ligtu.
Pelegrina.

Althaea armeniaca.
cannabina.
ficifolia.
kurdica.
pallida.
rosea.

Alyssum argenteum.
creticum.
podolicum.
saxatile.
sinuatum.
spinosum.
Wulfenianum.

Amarantus caudatus.
hypochondriacus.
polygamus.
retroflexus.

Amellus annuus.

Amethystea caerulea.

Ammi majus.

Amphicarpaea monoica.

Amsonia angustifolia.
Tabernaemontana.

Anacyclus officinarum.

Anaphalis cinnamomea.
nubigena.

Androsace lanuginosa.
occidentalis.
primuloides.

Andryala Agardhii.

Anemone albana.
decapetala.
Halleri.
multifida.
pennsylvanica.
pratensis.
Pulsatilla.
rivularis.
sylvestris.

Anemonopsis macrophylla.

Anoda hastata.

Anthemis macedonica.
montana.
tinctoria.

Anthericum Liliago.
ramosum.

Antirrhinum glutinosum.
hispanicum.
Orontium.

Apera arundinacea.

Aplopappus croceus.

Aquilegia canadensis
chrysantha.
coerulea.
flabellata.
glandulosa.
olympica.
pyrenaica.

Arabis bellidifolia.
petraea.
verna.

Arctotis stoechadifolia.

Arenaria aretioides..
Bertolonii.
cephalotes.
foliosa.
graminifolia.
gypsophiloides.
grandiflora.
laricifolia.
pinifolia.
purpurascens.
sajanensis.
saxatilis.

Argemone alba.
hispida.
mexicana.
ochroleuca.

Armeria canescens.
chilensis.
fasciculata.
latifolia.
majellensis.
plantaginea.
setacea.

Arnica latifolia.
longifolia.
montana.
sachalinensis.

Asclepias purpurascens.
tuberosa.

Asperula azurea.
galioides.
tinctoria.

Asphodeline liburnica.
lutea.

Asphodelus albus.

Aster alpinus.
Farreri.
himalaicus.
lichiangensis.
linariifolius.
Lipskyi.
Porterii.
pyrenaeus.
subcoeruleus.
vestitus.
yunnanensis.

Astilbe chinensis.
Davidii.
koreana.
rivularis.
simplicifolia.

Astragalus alopecuroides.
arcticus.
chinensis.
frigidus.
monspessulanus.
pentaglottis.
stipulatus.
xiphocarpus.

Astrantia carniolica.
helleborifolia.
pauciflora.

Athamanta Matthioli.

Atropa Belladonna.

Baeria coronaria.

Baptisia australis.
— var. minor.

Barbarea arcuata.

Beckmannia erucaeformis.

Bellium bellidioides.

Berkheya purpurea.
radula.

Beta trigyna.

Biscutella didyma.

Blumenbachia insignis.

Brachycome iberidifolia.

Brachypodium caespitosum.
japonicum.
pinnatum.
sylvaticum.

Brassica Cheiranthos.
Erucastrum.
juncea.
napus var. dichotoma.
oleracea.
rugosa.

Briza maxima.

Bromus breviaristatus.
ciliatus.
erectus.
japonicus.
Kalmii.
maximus.
rubens.
secalinus.
squarrosus.
unioloides.

Bulbinella Hookeri.

Buphthalmum salicifolium.

Bupleurum falcatum.
longifolium.
rotundifolium.
sachalinense.
stellatum.

Cakile maritima.

Calamagrostis Epigeios.

Calamintha alpina.
chinensis.

Calandrinia grandiflora.
speciosa.

Callirhoë lineariloba.
pedata.

Callistephus hortensis.

Camassia Fraseri.
Leichtlinii.
montana.

Camelina foetida.
linifolia.
sativa.

Campanula barbata.
bononiensis.
Grosseckii.
Imeretina.
kewensis.
Kolenatiana.
lactiflora.
lanata.
latifolia.
latiloba.
longistyla.
Loreyi.
macrostyla.
michauxioides.
patula.
phyctidocalyx.
primulaefolia.
pulla.
punctata.
Raddeana.
rhomboidalis.
sarmatica.
serotina.
speciosa.
spicata.
Waldsteiniana.

Capsella grandiflora.

Carbenia benedicta.

Carduus cernuus.
Kernerii.
tenuiflorus.

Carex binervis.
laevigata.
tribuloides.

Carlina acaulis var. caulescens.

Carthamus tinctorius.

Catananche coerulea.

Cathcartia villosa.

Celmisia coriacea.
grandiflora.
holosericea.
Lindsayi.
spectabilis argentea.
verbascifolia.

Celsia glandulosa.
pontica.

Centaurea atriplicifolia.
axillaris.
dealbata.
macrocephala.
montana.
moschata.
pulchra.
Rhaponticum.
rupestris.

Centranthus macrosiphon.

Cephalaria radiata.
tatarica.

Cerastium alpinum.
Biebersteinii.
macranthum.
perfoliatum.
tomentosum.

Chaerophyllum aromaticum.
nodosum.
roseum.

Charieis heterophylla.

Chelone obliqua.

Chenopodium ambrosioides.
Bonus-Henricus.
urbicum.

Chlorogalum pomeridianum.

Chorispora tenella.

Chrysanthemum Aucherianum.
carinatum.
caucasicum.
ceratophylloides.
cinerariaefolium.
coccineum.
coronarium.
corymbosum.
lacustre.
maximum.
pallens.

Chrysopon Gryllus.

Chrysopsis villosa.

Cicer arietinum.

Cimicifuga cordifolia.
dahurica.
foetida.
racemosa.
simplex.

Clarkia elegans.
pulchella.

Cnicus arachnoideus.
Diacantha.
ochroleucus.
syriacus.

Codonopsis ovata.

Coix Lacryma-Jobi.

Collinsia bicolor.
grandiflora.

Collomia coccinea.
gilioides.
grandiflora.

Conringia orientalis.

Convolvulus undulatus.

Coreopsis auriculata.
verticillata.

Coriandrum sativum.

Coronilla montana.

Cortusa Matthioli.

Corydalis capnoides.
lutea.
racemosa.

Cosmidium Burridgeanum.

Craspedia alpina.

Cremanthodium reniforme.
Thomsoni.

Crepis aurea.
blattarioides.
grandiflora.
rubra.
sibirica.

Crucianella aegyptiaca.

Cuminum Cyminum.

Cuphea lanceolata.
Zimapanii.

Cyananthus lobatus.

Cynoglossum furcatum.
nervosum.

Dactylis altaica.
Aschersoniana.

Dahlia variabilis.

Datura inermis.

Delphinium Brunonianum.
caucasicum.
Consolida.
decorum.
Delavayi.
elatum.
grandiflorum.
nudicaule.
occidentale.
pictum.
puniceum.
vestitum.

Deschampsia caespitosa.
flexuosa.
tenella.

Deyeuxia Langsdorfii.

Dianthus alpinus.
arenarius.
Armeria.
atrorubens.
caesius.
Carthusianorum.
Caryophyllus.
deltoides.
fragrans.
furcatus.
gallicus.
giganteus.
hirtus.
inodorus.
leptopetalus.
Lereschii.
monspessulanus.
neglectus.
pallidiflorus.
petraeus.
pubescens.
Requienii.
Seguieri.
sinensis.
subacaulis.
superbus.
sylvestris.
Tenorei.
Waldsteinii.

Dicentra thalictrifolia.

Dicranostigma leptopodum.

Dictamnus albus.

Digitalis laevigata.
lanata.

Dimorphotheca hybrida.
pluvialis.

Dipsacus asper.
ferox.

Dodecatheon Lemoinei.
Meadia.

Draba aizoides.
Bertolonii.
Dedeana.
fladnizensis.

Draba—*cont.*
frigida.
hirta.
incana.
rigida.
rupestris.
Salomonii.

Dracocephalum Moldavica.
parviflorum.

Dryas Drummondii.
lanata.
octopetala.

Ecballium Elaterium.

Eccremocarpus scaber.

Echinops bannaticus.
Tournefortii.

Elymus uralensis.

Emilia flammea.

Epilobium Dodonaei.
luteum.
rosmarinifolium.

Epipactis palustris.

Eragrostis abyssinica.
interrupta.

Eremostachys laciniata.

Eremurus himalaicus.
robustus.
— var. Elwesianus.

Erigeron bellidifolius.
Coulteri.
glabellus.
glaucus.
grandiflorus.
multiradiatus.
neo-mexicanus.
salsuginosus.
uniflorus.

Eriophyllum caespitosum.

Eriogonum racemosum.
subalpinum.

Erodium amanum.
Botrys.
gruinum.
macradenum.
Manescavii.
petraeum.

Eryngium alpinum.
giganteum.
palmatum.

Erysimum linifolium.
rupestre.

Eschscholzia californica.

Eucharidium concinnum.

Fedia Cornucopiae.

Ferula glauca.

Festuca heterophylla.
Myuros.
rigida.
tenella.

Fragaria indica.

Francoa ramosa.

Galax aphylla.

Galega orientalis.
patula.

Galium thymifolium.

Gaultheria trichophylla.

Gaudinia fragilis.

Gentiana asclepiadea.
crassicaulis.
Cruciata.
dahurica.
decumbens.
Fetissowii.
Freyniana.
Grombezewskii.
Kesselringii.
lutea.
macrophylla.

Gentiana—*cont*
phlogifolia.
septemfida.
straminea.
stylophora.
tibetica.
Waltonii.

Geranium albiflorum.
armenum.
dahuricum.
eriostemon.
Fremontii.
grandiflorum.
ibericum.
incisum.
nodosum.
rivulare.
sanguineum.
Wallichianum.

Gerbera Anandria.

Geum album.
bulgaricum.
chiloense.
Heldreichii.
montanum.
parviflorum.
rhaeticum.
triflorum.

Gilia achilleaefolia.
aggregata.
androsacea.
capitata.
dianthoides.
multicaulis.
squarrosa.
tricolor.

Gillenia trifoliata.

Glaucium corniculatum.
flavum var. tricolor.
leiocarpum.

Globularia cordifolia.
vulgaris.

Glyceria distans.
plicata.

Gomphrena globosa.

Gypsophila acutifolia.
elegans.
Steveni.
viscosa.

Haberlea Ferdinandi-Coburgii.

Hablitzia tamnoides.

Halenia elliptica.

Hastingsia alba.

Hebenstreitia comosa.

Hedysarum esculentum.
flavescens.
Semenovii.
sericeum.

Helianthemum Brewerii.
canum.
Tuberaria.

Helichrysum bracteatum.
Stoechas.

Helipterum Manglesii.
roseum.

Hemerocallis citrina.
flava.
minor.

Hesperis matronalis.

Heuchera Drummondii.
micrantha.

Hibiscus Trionum.

Hieracium alpinum.
amplexicaule.
Bornmülleri.
cappadocicum.
gymnocephalum.
Heldreichii.
Jankae.
lanatum.
pannosum.
racemosum.
villosum.

Hilaria rigida.

Horminum pyrenaicum.

Hosackia oblongifolia.

Hunnemannia fumariaefolia.

Hyacinthus azureus.
romanus.

Hymenophysa pubescens.

Hyoscyamus albus.

Hypecoum procumbens.

Hypericum confertum.
Coris.
delphicum.
linarifolium.
nummularium.
olympicum.
orientale.
polyphyllum.

Hypochaeris glabra.

Hysterionica pinifolia.

Iberis Amara.
Lagascana.
Tenoreana.

Incarvillea Delavayi.
grandiflora.

Inula barbata.
ensifolia.
hirta.
Hookeri.
macrocephala.
orientalis.
racemosa.
Royleana.
squarrosa.

Iris aurea.
Bulleyana.
Clarkei.
chrysographis.
foetidissima.
Forrestii.

Iris—*cont.*
Kaempferi.
laevigata.
mellita.
ochroleuca.
tenax.
versicolor.
Wilsonii.

Isatis glauca.

Isopyrum fumarioides.

Jasione perennis.

Jasonia tuberosa.

Juncus alpinus.
Chamissonis.
Gerardii.

Jurinia alata.
cyanoides.

Kochia trichophila.

Koeleria albescens.
phleoides.

Lactuca Bourgaei.
macrophylla.
perennis.

Lagurus ovatus.

Lallemantia canescens.

Lamarckia aurea.

Laserpitium Siler.

Lathyrus angulatus.
annuus.
Aphaca.
cirrhosus.
Clymenum.
cyaneus.
hirsutus.
Jordani.
laxiflorus.
luteus.
maritimus.
Nissolia.

Lathyrus—*cont.*
Ochrus.
pannonicus var. Smithii.
pisiformis.
polyanthus.
pubescens.
rotundifolius.
sativus.
setifolius.
tingitanus.
tuberosus.
undulatus.
variegatus.
venosus.

Laurentia tenella.

Lavatera cachemiriana.
thuringiaca.
trimestris.

Layia elegans.

Leontopodium alpinum.

Leptarrhena amplexifolia.

Leptosyne Douglasii.
maritima.

Leucojum aestivum.
vernum.

Liatris elegans.
spicata.

Ligusticum pyrenaicum.
scoticum.

Lilium dalmaticum.
giganteum.
pardalinum.
pyrenaicum.

Limnanthes alba.
Douglasii.

Linaria alpina.
dalmatica.
multipunctata.
saxatilis.
triphylla.
tristis.

Linum capitatum.
monogynum.
nervosum.
usitatissimum.

Loasa vulcanica.

Lobelia cardinalis.
ramosa.
syphilitica.

Lotus Tetragonolobus.

Lupinus luteus.
micranthus.
mutabilis.
nanus.
perennis.
pilosus.
subcarnosus.

Luzula Hostii.
nivea.

Lychnis alpina.
chalcedonica.
Flos-jovis.
fulgens.
Lagascae.
nigrescens.
Preslii.
Sartorii.

Lycurus phleoides.

Lysimachia clethroides.

Lythrum alatum.

Madia sativa.

Malcomia maritima.

Malva Alcea.
moschata.
parviflora.

Malvastrum campanulatum.
limense.

Meconopsis aculeata.
cambrica.
latifolia.
paniculata.
Prattii.
simplicifolia.
Wallichii.

Medicago Echinus.
Murex.
orbicularis.
turbinata.

Melanthium virginicum.

Melica altissima.
ciliata.

Mentzelia Lindleyi.

Meum athamanticum.

Mirabilis divaricata.
Jalapa.

Molinia caerulea.

Moltkia petraea.

Monarda fistulosa.

Monolepis trifida.

Morina betonicoides.
longifolia.

Muscari armeniacum.
comosum.
compactum.
neglectum.
paradoxum.

Myosurus minimus.

Narcissus Bulbocodium.

Nardus stricta.

Nepeta concolor.
discolor.
nuda.

Nicandra physaloides.

Nicotiana rustica.
Tabacum.

Nigella damascena.
hispanica.
sativa.

Oenothera acaulis.
amoena.
fruticosa.
odorata.
pumila.
speciosa.
tenella.

Omphalodes linifolia.

Ononis reclinata.

Onosma albo-roseum.

Orchis foliosa.

Origanum Majorana.

Ornithogalum arcuatum.
narbonense.

Oxytropis argentea.
baicalensis.
ochroleuca.
pilosa.
strobilacea.

Paeonia anomala.
Emodi.
hirsuta.
lutea.
paradoxa.
Woodwardii.

Panicum capillare.
obtusum.

Papaver alpinum.
commutatum.
laevigatum.
lateritium.
nudicaule.
orientale.
pavoninum.
pilosum.
rupifragum.
somniferum.

Paradisia Liliastrum.

Parnassia mysorensis.
palustris.

Patrinia palmata.

Pennistum latifolium.
macrourum.

Pentstemon acuminatus.
alpinus.
arizonicus.
barbatus.
confertus.
deustus.
diffusus.
gentianoides.
glaber.
glaucus.
gracilis.
heterophyllus.
humilis.
laevigatus.
ovatus.
Scouleri.
secundiflorus.

Petunia nyctaginiflora.

Peucedanum coriaceum.
graveolens.

Phaecasium pulchrum.

Phalaris tuberosa.

Phlomis cashmiriana.
pratensis.
tuberosa.
umbrosa.
viscosa.

Physalis Alkekengi.
Bunyardii.
Franchetii.

Physochlaina orientalis.

Physospermum cornubiense.

Physostegia virginiana.

Phyteuma canescens.
Michelii.
orbiculare.
Scheuchzeri.
serratum.
spicatum.

Pimpinella Anisum.

Plantago argentea.
Coronopus.
Cynops.
maritima.
Myosurus.
Psyllium.

Platycodon grandiflorum.
— var. Mariesii.

Pleurospermum Golaka.

Poa caesia.
violacea.

Podolepis acuminata.

Podophyllum Emodi.

Polemonium foliosissimum.
mexicanum.

Polygonum affine.
alpinum.
molle.
multiflorum.
viviparum.

Polypogon monspeliensis.

Portulaca grandiflora.

Potentilla argyrophylla.
calycina.
crinita.
cryptotaenia.
eriocarpa.
glandulosa.
gracilis.
Herbichii.
Meyeri.
montenegrina.
Mooniana.
multifida.

Potentilla—*cont.*
nepalensis.
nevadensis.
pedunculata.
pennsylvanica.
recta.
rivalis.
rupestris.
sericea.
tanacetifolia.
villosa.

Poterium alpinum.
canadense.
muricatum.
obtusum.

Preslia cervina.

Primula Beesiana.
conspersa.
Edina.
pulverulenta.
reticulata.
rosea.
sikkimensis.
Smithiana.
Wardii.
Winsonii.

Psoralea acaulis.
macrostachya.
physodes.

Pycnanthemum lanceolatum.

Ramondia pyrenaica.

Ranunculus aconitifolius.
Gouanii.
millefoliatus.
nissanus.
platanifolius.

Rehmannia angulata.

Reseda virgata.

Rheum acuminatum.
Alexandrae.
nobile.
Ribes.

Ricotia Lunaria.

Rodgersia aesculifolia.
pinnata.
sambucifolia.
tabularis.

Roemeria hybrida.

Rudbeckia ampla.
amplexicaulis.

Rumex flexuosus.
hymenosepalus.
salicifolius.

Salvia argentea.
Bertolonii.
carduacea.
Columbariae.
glutinosa.
Horminum.
Sclarea.
verticillata.
virgata.
viscosa.

Sambucus Ebulus.

Santolina pinnata.

Saponaria ocymoides.
Vaccaria.
Wiemannii.

Saussurea albescens.
deltoides.
discolor.
pectinata.

Saxifraga Aizoon var. balcana.
calabrica.
carniolica.
catalaunica.
cartilaginea.
cochlearis.
— var. minor.
crustata.
decipiens.
Delavayi.
diversifolia.
exarata.
granulata.

Saxifraga—*cont.*
Haagei.
hirsuta.
Hostii.
lingulata.
— var. lantoscana.
longifolia.
luteo-viridis.
Macnabiana.
manshuriensis.
marginata.
Mertensiana.
montavoniensis.
mutata.
nivalis.
pedemontana.
petraea.
rotundifolia.
tyrolensis.
yunnanense.

Scabiosa brachiata.
candicans.
caucasica.
Columbaria.
crenata.
daucoides.
gramuntia.
prolifera.
Pterocephala.

Scilla autumnalis.
Lilio-hyacinthus.

Scolymus hispanicus.
maculatus.

Scopolia sinensis.

Scorzonera hispanica.
purpurea.

Sedum altissimum.
anopetalum.
elongatum.
Ewersii.
kamtschaticum.
pilosum.
reflexum.
roseum.
spathulifolium.
stoloniferum.
Woodwardii.

Selinum tenuifolium.
vaginatum.

Senecio abrotanifolius.
adonidifolius.
clivorum.
diversifolius.
Doria.
Doronicum.
elegans.
japonicus.
Ledebouri.
Ligularia.
Przewalskii.
squalidus.
stenocephalus.
Veitchianus.
Wilsonianus.

Serratula atriplicifolia.
heterophylla.
quinquefolia.
tinctoria.

Seseli elatum.
osseum.

Setaria glauca.
italica.

Sidalcea candida.
malvaeflora.
neo-mexicana.

Siderites scordiodes.

Silene alpestris.
Armeria.
Asterias.
conica.
conoidea.
cretica.
elegans.
fimbriata.
italica.
linicola.
longicilia.
muscipula.
noctiflora.
nocturna.
nutans.
Otites.
pendula.

Silene—*cont.*
quadrifida.
Reichenbachii.
Saxifraga.
Schafta.
squamigera.
vallesia.
verecunda.
viridiflora.
Zawadskii.

Silphium Asteriscus.

Silybum eburneum.
Marianum.

Sium sisarum.

Smyrnium Olusatrum.
perfoliatum.

Specularia pentagonia.
perfoliata.
Speculum.

Stachys coccinea.
grandiflora.
lanata.

Statice Bonduellii.
sinuata.
Suwarowii.

Stipa tenacissima.

Swertia dilatata.
Hookeri.
Kingii.
longifolia.
perennis.

Symphyandra Hofmannii.
pendula.
Wanneri.

Synthyris reniformis.

Tanacetum argenteum.

Tellima grandiflora.

Teucrium canadense.
flavum.
lucidum.

Thalictrum aquilegifolium.
calabricum.
corynellum.
Delavayii.
dipterocarpum.
flavum.
minus.
Przewalskii.
squarrosum.

Thermopsis fabacea.
lanceolata.

Thymus odoratissimus.

Trautvetteria palmata.

Trifolium alpestre.
ochroleucum.
pannonicum.
physodes.

Trigonella coerulea.
corniculata.
Foenum-graecum.
polycerata.

Trillium grandiflorum.

Trollius pumilus.
sinensis.
yunnanensis.

Troximon laciniatum.

Tunica graminea.

Urospermum Dalechampii.

Valerianella eriocarpa.

Verbascum Blattaria.
Chaixii.
Lychnites.
olympicum.
phlomoides.
phoeniceum.
speciosum.

Verbena bonariensis.

Veronica austriaca.
Bidwillii.
Colensoi glauca.
fruticulosa.
gentianoides.
grandis.
incana.
Lyallii.
orientalis.
saxatilis.
spicata.
virginica.

Vicia angustifolia.
calcarata.
grandiflora.

Vicia—*cont.*
melanops.
pyrenaica.
striata.
sylvatica.
unijuga.

Vincetoxicum fuscatum.

Viola altaica.
cornuta.
persicifolia.
primulaefolia.

Zephyranthes minima.

Zygadenus elegans.
venenosus.

TREES AND SHRUBS.

Those marked with an asterisk were not grown at Kew.

Acanthopanax divaricatum.
sessiliflorum.
setchuenense.

Acer circinatum.
dasycarpum.
glabrum.
Heldreichii.
hyrcanum.
insigne.
Lobelii.
macrophyllum.
micranthum.
Miyabei.
monspessulanum.
neglectum.
nikoense.
opulifolium.
pennsylvanicum.
tataricum.
tetramerum.
Trautvetteri.
Tschonoskii.

Actinidia arguta.

Aesculus flava.
glabra.
indica.

*Akebia lobata.

Alnus cordifolia.
elliptica.
firma.
glutinosa.
incana.
japonica.
mollis.
nitida.
oregona.
orientalis.
serrulata.
sitchensis.
tenuifolia.
viridis.

Amelanchier canadensis.
florida.
vulgaris.

Aralia chinensis.
— var. glabrescens.

Arctostaphylos Uva-Ursi.

Berberis aggregata.
angulosa.
aristata.
atrocarpa.
Beaniana.
brachypoda.
canadensis.
Chitria.
concinna.
consimilis.
Darwinii.
diaphana.
dictyophylla.
dubia.
Edgeworthiana.
Francisci-Ferdinandii.
Gagnepainii.
Guimpelii.
Hookeri.
Lycium.
koreana.
Leichtlinii.
orthobotrys.
polyantha.
Prattii.
Sargentiana
Sieboldii.
sinensis.
Soulieana.
Stapfiana.
subcaulialata.
thibetica.
Thunbergii.
Tischleri.
umbellata.
Veitchii.
virescens.
Wilsonae.
yunnanensis.

Betula coerulea.
corylifolia.
Ermanii.
— var. nipponica.
fruticosa.
humilis.
japonica var. mandshurica.
— var. szechuanica.
kenaica.
lenta.
lutea.
Maximowiczii.
Medwediewii.
occidentalis.
papyrifera.
populifolia.
pumila.
utilis.

Bruckenthalia spiculifolia.

Buddleia albiflora.
japonica.
nivea.
variabilis.
— var. Veitchiana.
yunnanensis.

Bupleurum fruticosum.

Buxus sempervirens.

Callicarpa Giraldiana.
gracilis.
japonica.

Calycanthus Mohrii.
occidentalis.

Camellia cuspidata.

Caragana arborescens.
aurantiaca.
Boisii.
decorticans.
frutescens.
microphylla.

Carmichaelia australis.
flagelliformis.
odorata.

Carpinus caroliniana.
orientalis.
Turczaninowii.

Cassinia fulvida.

Castanopsis chrysophylla.

Ceanothus integerrimus.
papillosus.
thyrsiflorus.
velutinus.

Cedrus atlantica.
Deodora.
Libani.

Celastrus articulatus.
flagellaris.
scandens.

Celtis glabrata.
occidentalis.
Vilmoriniana.

Cephalotaxus drupacea.
Fortunei.
pedunculata.

Cercis Siliquastrum.

Chimonanthus fragrans.

Chionanthus virginica.

Cistus albidus.
crispus.
hirsutus.
laurifolius.
platysepalus.
salvifolius.
tauricus.

Cladothamnus pyrolaeflorus.

Cladrastis amurensis.

Clematis aethusifolia var.
latisecta.
akebioides.
alpina.
connata.

Clematis—*cont.*
— var. velutina.
Fargesii.
fusca.
Gauriana.
grata.
heracleaefolia.
integrifolia.
intermedia.
ligusticifolia.
mandshurica.
montana.
— var. rubens.
orientalis.
Pitcheri.
pseudo-flammula.
Rehderiana.
Scottii.
Spooneri.
tangutica.
Veitchiana.
virginiana.

Clerodendron Fargesii.
trichotomum.

Clethra acuminata.
alnifolia.
— var. paniculata.
monostachya.

Colutea bullata.
longialata.
media.
orientalis.

Corema album.

Cornus alba.
Amomum.
Baileyi.
Bretschneideri.
candidissima.
glabrata.
Nuttallii.
officinalis.
pubescens.
sanguinea.
stolonifera.

Cotoneaster acutifolia.
— var. villosula.
affinis.
amoena.
apiculata.
applanata.
bacillaris.
— var. obtusata.
bullata.
buxifolia.
divaricata.
Fontanesii.
foveolata.
Franchetii.
frigida.
— var. aurea.
Harroviana.
hebephylla.
Henryana.
horizontalis.
humifusa.
hupehensis.
laxiflora.
Lindleyi.
lucida.
microphylla.
moupinensis.
multiflora.
nitens.
Nummularia.
obscura.
pannosa.
pekinensis.
prostrata.
rotundifolia.
salicifolia var. floccosa.
— var. rugosa.
Simonsii.
thymifolia.
tomentosa.
uniflora.
Zabelii.

Crataegus acclivis.
altaica.
ambigua.
Arnoldiana.
Azarolus.
basilica.
Beckwithae.
Boyntonii.
Buckleyi.
canadensis.
Carrierei.
coccinea.
cordata.

Crataegus—*cont.*
cuneata.
dilatata.
Downingii.
durobrivensis.
Ellwangeriana.
elongata.
foetida.
Forbesae.
georgiana.
glandulosa.
grigoniensis.
Henryi.
infera.
intricata.
Jonesae.
Lambertiana.
leptophylla.
Macauleyi.
macracantha.
mollis.
neo-Canbyi.
oppositifolia.
orientalis.
persimila.
praecox.
pratensis.
Pringlei.
prunifolia.
pubescens var. stipulacea.
punctata.
semi-orbiculata.
sinaica.
succulenta.
tanacetifolia.
verecunda.
viridis.
Wheeleri.

Cupressus Goveniana.
Lawsoniana.
nootkatensis.
pisifera.
thyoides.
torulosa.

Cydonia Maulei.

Cytisus biflorus.
capitatus.
Heuffelii.
horniflorus.
monspessulanus.
nigricans.
— var. Carlieri.
purgans.
purpureus.
scoparius.
— var. Andreanus.
sessilifolius.

Daboëcia polifolia.

Daphniphyllum macropodum.

Davidia laeta.

Decaisnea Fargesii.

Deutzia compacta.
corymbosa.
crenata.
globosa.
glomeruliflora.
gracilis.
longifolia.
— var. Veitchii.
macrocephala.
mollis.
planifolia.
reflexa.
Sieboldiana.
Vilmoriniae.
Wilsonii.

Diervilla Lonicera.
rivularis.
sessilifolia.

Dipelta floribunda.
ventricosa.

Distylium racemosum.

Elaeagnus argentea.
multiflora.
umbellata.

Eleutherococcus Henryi.
leucorrhizus.
— var. fulvescens.
scaberulus.
Simonii.

Enkianthus campanulatus.

Erica australis.
cinerea.
lusitanica.
scoparia.
stricta.
Tetralix.

Eucryphia pinnatifolia.

Euonymus Bungeanus.
Hamiltonianus.
japonicus.
latifolius.
oxyphyllus.
planipes.
ussuriensis.
yedoensis.

Evodia hupehensis.

Exochorda Albertii.
Giraldii.
grandiflora var. Wilsonii.

Fontanesia phillyraeoides.

Fothergilla Gardenii.
major.

Fraxinus Ornus.
parvifolia.
pennsylvanica.

Garrya elliptica.

Gaultheria cuneata.
procumbens.
Shallon.

Gaylussacia dumosa.
resinosa.

Genista aethnensis.
germanica.
hispanica.
pilosa.
radiata.
tinctoria.
— var. elatior.
— var. mantica.
virgata.

Halesia hispida.
tetraptera.

Hamamelis arborea.
— var. Zuccariniana.
japonica.
mollis.

Helianthemum alyssoides.
polifolium.
vulgare.

Hydrangea aspera.
Bretschneideri.
canescens.
longipes.
paniculata.
petiolaris.
radiata.
vestita.
xanthoneura.
— var. glabrescens.
— var. Wilsonii.

Hymenanthera crassifolia.

Hypericum Androsaemum.
aureum.
Buckleii.
elatum.
galioides.
hircinum.
Hookerianum.
inodorum.
Kalmianum.
orientalis.
patulum.
— var. Henryi.
perforatum
prolificum.
uralum.

Ilex cornuta.
opaca.
Pernyi.
Sieboldii.
verticillata.

Indigofera Gerardiana.

Jasminum Beesianum.
fruticans.
humile.
nudiflorum.

Kalmia cuneata.
glauca.
latifolia.

Laburnum alpinum.
vulgare.

Ledum latifolium.
palustre.

Leiophyllum buxifolium.

Leucothöe Davisiae.
racemosa.

Leycesteria formosa.

Ligustrum Delavayanum.
Ibota.
insulare.
japonicum.
medium.
Prattii.
Quihoui.
yunnanense.

Lonicera alpigena.
chaetocarpa.
coerulescens.
conjugalis.
deflexicalyx.
Delavayi.
depressa.
dioica.
Ferdinandii.
floribunda.
Giraldii.
gynochlamydea.
Henryi.
involucrata.
Kesselringii.
Koehneana.
lanceolata.
longa.
Maackii.
micrantha.
obovata.

Lonicera—*cont.*
orientalis.
ovalis.
pileata.
prostrata.
Ruprechtiana.
Sullivantii.
— var. hirsuta.
syringantha.
tatarica.
tragophylla.
translucens.
trichopoda.

Lupinus arboreus.

Lycium chinense.

Lyonia ligustrina.

Magnolia acuminata.
parviflora.
tripetala.
Wilsonii.

Meliosma cuneifolia.

Menispermum canadense.

Menziesia globularis.

Microglossa albescens.

Myricaria germanica.

Neillia amurensis.
capitata.
opulifolia.
stellata.
thibetica.
Torreyi.

Nesaea salicifolia.

Nuttallia cerasiformis.

Nyssa sylvatica.

Olearia Haastii.
odorata.

Ononis fruticosa.

Paliurus australis.

Peraphyllum ramossimum.

Pernettya mucronata.

Pertya sinensis.

Petteria ramentacea.

Phellodendron amurense.
chinense.
Lavallei.

Philadelphus acuminatus.
brachybotrys.
californicus.
columbianus.
coronarius.
Falconeri.
Gordonianus.
incanus.
inodorus.
insignis.
latifolius.
Lewisii.
pekinensis.
pubescens.
Satsumii.
sericanthus.
speciosissimus.
tomentosus.
Wilsonii.

Phillyrea angustifolia.

Photinia Beauverdiana.
— var. notabilis.
subumbellata.
variabilis.

Phyllodoce Breweri.
empetriformis.

Pieris formosa.
japonica.
mariana.

Pinus Armandii.
Bungeana.
*halepensis.
koraiensis.
Peuke.

Piptanthus nepalensis.

Platanus acerifolia.
hispanica.
orientalis.

Potentilla fruticosa.
micrandra.

Prunus cornuta.
emarginata.
japonica.
pennsylvanica.

Pseudolarix Fortunei.

Ptelea isophylla.
trifoliata.

Pyracantha angustifolia.
coccinea.
crenulata.
— var. Rogersiana.
Gibbsii.

Pyrus alnifolia.
alpina.
americana.
— var. nana.
arbutifolia.
Aria var. majestica.
— var. salicifolia.
Aucuparia var. moravica.
auricularis.
crataegifolia.
floribunda.
Folgneri.
glomerulata.
Hostii.
hybrida.
kansuensis.
Keissleri.
Meinichii.
minima.
munda.
— var. subarachnoidea.
Niedzwetzkyana.
nigra.
pinnatifida.
pohuashanensis.
Prattii.
prunifolia.
Ringo.

Pyrus—*cont.*
rotundifolia.
sambucifolia.
Sargentii.
scalaris.
sikkimensis.
sorbifolia.
Sorbus.
theifera.
Toringo.
Torminalis.
transitoria var. toringoides.
Tschonoskii.
Vilmorinii.
yunnanensis.
Zahlbruckneri.
Zumi.

Quercus fulhamensis.
Kelloggii.
Libani.
obtusata.
rubra.

Raphiolepis japonica.

Rhamnus cathartica.
davurica.
fallax.
Frangula.
infectoria.
japonica.
mandshurica.
Purshiana.
utilis.

Rhododendron ambiguum.
Augustinii.
brachycarpum.
californicum.
concinnum.
Davidsonianum.
decorum.
discolor.
ferrugineum.
Fortunei.
halense.
hippophaeoides.
hirsutum.
impeditum.
japonicum.
lepidotum.

Rhododendron—*cont.*
maximum.
Metternichii.
micranthum.
oreotrephes.
polylepis.
punctatum.
racemosum.
rhombicum.
rubiginosum.
Smirnowii.
Vaseyi.
Vilmorinianum.
viscosum.
yanthinum.
yunnanense.

Rhodotypos kerrioides.

Rhus Potaninii.

Ribes alpinum.
amictum.
bracteosum.
cruentum.
divaricatum.
futurum.
holosericeum.
mandshuricum.
robustum.
rotundifolium.
stenocarpum.

Robinia Kelseyi.

Rosa alpina.
— var. pyrenaica.
baicalensis.
coruscans.
Davidii.
— var. elongata.
elegantula.
glutinosa.
gymnocarpa.
Helenae.
Hugonis.
humilis.
lucens.
Luciae.
macrophylla.
microphylla.
mollis.
Moyesii.

Rosa—*cont.*
multibracteata.
nitida.
nutkana.
omeiensis.
— var. atrosanguinea.
— var. polyphylla.
— var. pteracantha.
pisocarpa.
pratincola.
rubrifolia.
rugosa.
Seraphinii.
sericea.
sertata.
setipoda.
sicula.
Soulieana.
spinulifolia.
Sweginzowii.
Webbiana.
Willmottiae.
Woodsii.

Rubus adenophorus.
biflorus var. quinqueflorus.
canadensis.
chroosepalus.
coreanus.
flosculosus.
Giraldianus.
inopertus.
lasiostylus.
— var. dizygos.
mesogaeus.
nigro-baccus.
nutkanus.
occidentalis.
odoratus.
omeiensis.
parvifolius.
phoenicolasius.
pubescens.
thibetanus.
xanthocarpus.

Ruta graveolens.

Schizandra chinensis.

Sciadopitys verticillata.

Securinega fluggeoides.
ramiflora.

Skimmia japonica.

Sophora flavescens.
viciifolia.

Spartium junceum.

Spiraea Aitchisonii.
arborea.
— var. glabrata.
arcuata.
bella.
betulifolia.
bracteata.
canescens.
chamaedrifolia.
discolor.
— var. dumosa.
expansa.
Henryi.
japonica.
— var. ovalifolia.
laevigata.
Lindleyi.
longigemmis.
mollifolia.
Nobleana.
Rosthornii.
salicifolia.
sorbifolia.
— var. stellipila.
tomentosa.
Veitchii.
vestita.
Wilsonii.

Stachyurus chinensis.

Staphylea colchica.
Coulombieri.
pinnata.
trifolia.

Stephanandra Tanakae.

Stewartia pentagyna.
Pseudo-camellia.

Stranvaesia Davidiana,
var. undulata.
salicifolia.

Styrax americanum.
japonicum.
Obassia.
Wilsonii.

Symphoricarpus Heyeri.
mollis.

Syringa albo-rosea.
Emodi.
japonica.
pekinensis.
villosa.
Wilsonii.

Taxus cuspidata.

Thuya japonica.
orientalis.
plicata.

Trochodendron aralioides.

Umbellularia californica.

Vaccinium Arctostaphylos
corymbosum.
hirsutum.
ovatum.
pallidum.
Vitis-idaea.

Viburnum americanum.
betulifolium.
brevipes.
Canbyi.
cotinifolium.
Davidii.
Henryi.
hupehense.
ichangense.
Lantana.
lobophyllum.
ovatifolium.
pubescens.
rhytidophyllum.
Sargentii.
theiferum.
Veitchii.
venosum.
Wilsonii.

Zanthoxylum alatum.
Bungei.
piperitum.

*Zelkova sinica.

Zenobia speciosa.
— var. pulverulenta.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1921.

LIST of STAFFS of the ROYAL BOTANIC GARDENS, Kew, and of Botanical Departments, Establishments and Officers at Home, and in India and the Colonies, in Correspondence with Kew.

* Trained at Kew. † Recommended by Kew.

Royal Botanic Gardens, Kew.—

Director	Lieut.-Col. Sir David Prain, I.M.S., C.M.G., C.I.E., M.A., M.B., LL.D., F.R.S., F.L.S.
Assistant Director	Arthur W. Hill, M.A., Sc.D., F.R.S., F.L.S.
Assistant	*John Aikman.
,,	*William Nicholls Winn.
Keeper of Herbarium and Library	Otto Stapf, Ph.D., F.R.S., F.L.S.
Assistant	Charles Henry Wright, A.L.S.
,,	*Sidney Alfred Skan.
,,	Thomas Archibald Sprague, B.Sc., F.L.S.
,,	Elsie Maud Wakefield, M.A., F.L.S.
,,	*William Bertram Turrill, M.Sc.
,,	*John Hutchinson, F.L.S.
,,	K. W. Braid, B.A., B.Sc., A.I.C.
,, for India	S. T. Dunn, B.A.
,, for South Africa	
Artist	Arthur Kellett.
Assistant Keeper, Jodrell Laboratory	Leonard Alfred Boodle, F.L.S.
Keeper of Museums	John Masters Hillier.
Assistant	*John H. Holland, F.L.S.
,,	*William Dallimore.
Preparer	Laurance John Harding.

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Royal Botanic Gardens, Kew—*continued.*

Curator of the Gardens - - - William Watson, A.L.S.
Assistant Curator - - - - *William J. Bean.
Foremen:—
Herbaceous Department - - *Walter Irving.
Arboretum - - - - - *Arthur Osborn.
Greenhouse and Ornamental Department. *John Coutts.
Tropical Department - - - *William Taylor.
Temperate House - - - - *Charles P. Raffill.
Storekeeper - - - - - *George Dear.

Imperial Bureau of Mycology, Kew:—
Director - - - - - - E. J. Butler, C.I.E., D.Sc., M.B., F.L.S.

Aberdeen.—University Botanic Garden:—
Professor - - - W. G. Craib, M.A., F.R.S.E., F.L.S.

Cambridge.—University Botanical Department:—
Professor - - - A. C. Seward, M.A., F.R.S., F.L.S.
Director of Garden, and Curator, University Herbarium. } H. G. Carter, M.B., Ch.B.
Curator, University Museum. } H. H. Thomas, B.A.
Curator of Garden - *F. G. Preston.

Dublin.—Royal Botanic Gardens, Glasnevin:—
Keeper - - - Sir Frederick W. Moore, M.A., F.L.S.
Assistant - - - *J. W. Besant.

Trinity College Botanic Gardens:—
Professor - - - H. H. Dixon, Sc.D., F.R.S.

Edinburgh.—Royal Botanic Garden:—
Regius Keeper - - Sir Isaac B. Balfour, K.B.E., M.A., M.D., LL.D., Sc.D., F.R.S., F.L.S.
Assistant to Regius Keeper. W. W. Smith, M.A., F.L.S.
Assistant (Museum) - H. F. Tagg, F.L.S.
,, (Herbarium) - W. E. Evans, B.Sc.
,, (Laboratory) - M. Y. Orr.
Head Gardener - - *R. L. Harrow.
Plant Propagator - - L. B. Stewart.
Assistant Gardener - D. R. Oliver.
Foremen:—
Arboretum - - A. Johnstone.
Glass Department - J. J. Campbell.
Herbaceous Department. A. McCutcheon.

Glasgow.—Botanic Gardens:—
University Professor - F. O. Bower, M.A., Sc.D., F.R.S., F.L.S.
Curator - - - James Whitton.

London.—Chelsea Physic Garden:—

Curator - - -	*W. Hales, A.L.S.

Oxford.—University Botanic Garden:—

Professor - - -	F. W. Keeble, C.B.E., M.A., Sc.D., F.R.S.
Curator - - -	*William G. Baker.
Curator, Fielding Herbarium.	G. C. Druce, M.A., F.L.S.

AFRICA.

Union of South Africa.—

Pretoria.—Department of Agriculture:—

Chief, Division of Botany -	†I. B. Pole Evans, C.M.G., M.A., D.Sc., F.L.S.
Mycologist - - - -	Ethel M. Doidge, M.A., D.Sc., F.L.S.
,, (Herbarium) -	A. M. Bottomley, B.A.
Botanist-in-Charge, National Herbarium.	E. P. Phillips, M.A., D.Sc., F.L.S.
Economic Botanist - -	Sydney M. Stent.

Natal Herbarium (Durban):—

Mycologist in charge - -	——
Government Mycologist (Cape Town) -	V. A. Putteril, M.A.

Department of Forests:—

Chief Conservator - -	C. E. Legat, B.Sc.

Cape Town.—National Botanic Garden:—

Director - - - -	R. H. Compton, M.A.
Curator - - - -	*J. W. Mathews.
Gardener - - - -	*F. J. Cook.

Cape Province.—

Cape Town.—University of Cape Town:—

Harry Bolus Professor of Botany - - - -	D. Thoday, M.A.
Harold Pearson Professor of Botany - - - -	R. H. Compton, M.A.

South African Museum Herbarium:—

Assistant in charge - -	——
Curator, Bolus Herbarium -	Mrs. F. Bolus, B.A.
Assistant - - - -	N. S. Pillans.

Gardens and Public Parks:—

Superintendent - - -	——

Grahamstown.—Albany Museum:—

Superintendent of Herbarium.	S. Schönland. M.A. Ph.D.

Garden and Public Parks:—

Curator - -	E. J. Alexander.
Port Elizabeth - Superintendent -	John T. Butters.
King Williamstown. Curator - - -	George Lockie.
Graaff-Reinet - ,, - - -	*C. J. Howlett.
Uitenhage - ,, - - -	H. Fairey.

Natal.—

Durban.—Municipal Gardens:—
Curator - - - *H. Rutter.

Pietermaritzburg.—Botanic Garden:—
Curator - - - *H. H. Kidd.

Transvaal.—

Pretoria.—Transvaal Museum:—
Superintendent of Herbarium. - Mrs. R. Pott.

University of South Africa.—

Bloemfontein	Professor of Botany	G. Potts, M.Sc., Ph.D.
Grahamstown	,, ,,	S. Schönland, M.A., Ph.D.
Johannesburg	,, ,,	C. E. Moss, M.A., D.Sc., F.L.S.
Pietermaritzburg.	,, ,,	J. W. Bews, M.A., D.Sc.
Pretoria	,, ,,	H. A. Wager, A.R.C.S.

University of Stellenbosch.—

	Professor of Botany	W. Nel, M.A.
	,, ,, Phytopathology and Mycology.	P. van der Bijl, M.A., F.L.S.

Egypt.—

Cairo.—Ministry of Agriculture:—
Inspector General - A. T. McKillop.
Botanical Section:—
Director - - - E. Shearer, M.A., B.Sc.
,, - - - T. Trought, B.A.
Mycologist - - - H. R. Briton-Jones.
Experimental Farms:—
Inspector - - - M. W. Gray, M.A., B.Sc.
Horticultural Section:—
Director - - - *T. W. Brown, F.L.S.
Assistant Director - *F. G. Walsingham.
Superintendent - - *G. S. Crouch.
——— ,, *H. L. R. Chapman.

Gold Coast.—Agricultural Department:—
Director - - - W. S. D. Tudhope.
Deputy Director - ———
Mycologist and Assistant Director. - R. H. Bunting.
Assistant Mycologist - †H. A. Dade.
Senior Superintendent *A. E. Evans.
,, ,, *A. C. Miles.
,, ,, A. Ogilvie.
,, ,, C. H. Knowles, B.Sc.
Superintendents - - C. Saunders.
,, - - *A. B. Culham.
,, - - *T. Hunter.
,, - W. Caldwell.

Gold Coast—*continued*.

	Assistant dents.	*G. H. Eady.
	,, ,,	M. D. Reece.
	,, ,,	*W. C. Fishlock.
	,, ,,	G. C. Coull, B.Sc.
	,, ,,	T. J. S. Smellie.
	,, ,,	H. J. Horwood, B.A.
	,, ,,	A. W. Patterson.
	,, ,,	J. Steele.
	Supervisor of Fruit and Vegetable Farms.	*M. Vardy.
	,, ,,	A. A. L. Smith.
	Conservator of Forests -	N. C. McLeod.

Kenya Colony and Protectorate.—

Nairobi -	- Director of Agriculture.	A. Holm.
	Deputy Director of Agriculture.	——
	Mycologist - -	——
	Assistant Mycologist -	J. McDonald, B.Sc.
	Plant Breeder - -	†G. J. L. Burton.
	Plant Import Inspector	†C. C. T. Sharpe.
	Horticulturist - -	*C. B. Ussher.
	Coffee Plant Inspector -	A. D. Le Poer Trench.
	Manager, Kabete Experimental Farm.	†A. J. Wilson.
	Tropical Agricultural Instructor.	——
	Agricultural Instructor -	*F. B. Butler.
	,, ,,	*J. Sparrow.
	Conservator of Forests -	E. Battiscombe.
Vasin Gishu -	Manager of Experimental Farm.	J. Johnston.

Nigeria.—Agricultural Department :—

	Director of Agriculture.	†O. T. Faulkner, B.A.
	Assistant Director -	P. H. Lamb.
	Mycologist - - -	†T. Laycock.
	Superintendent of Agriculture.	†T. Evans, F.L.S.
	,, ,,	K. T. Rae.
	,, ,,	†A. W. C. Budge, M.M., B.Sc.
	,, ,,	†J. E. Gray, B.A.
	,, ,,	†J. O'N. Hewitt, A.R.C.S.
	,, ,,	J. M. Lonsdale.
	,, ,,	†J. R. Mackie, B.Sc.
	,, ,,	H. Roebuck.
	,, ,,	†R. Swainson-Hall, F.L.S.
	,, ,,	H. B. Waters, B.A.
	Assistant Superintendent.	A. J. Findlay, M.A., B.Sc.
	,, ,,	H. G. Burr, B.Sc.
	,, ,,	R. Nicol.
	,, ,,	T. Thornton.
	,, ,,	†L. A. Wainwright.
	,, ,,	H. N. Thompson, C.M.G.
	Director of Forests - -	

Nyasaland Protectorate.—

Zomba.—Agricultural and Forestry Department:—

Director of Agriculture	†E. J. Wortley, F.C.S.
Assistant Director -	*E. W. Davy.
Agriculturist - -	E. Grove-White.
,,	F. Barker.
,,	B. Browne.
Tobacco Inspector -	W. D. Broadfoot.
Chief Forest Officer - -	*J. M. Purves.

Rhodesia.—

Bulawayo.—Rhodes Matopos Park:—

Curator - - -	W. E. Dowsett.

Salisbury.—Department of Agriculture:—

Director - - -	E. A. Nobbs, Ph.D., B.Sc.
Agriculturist and Botanist.	H. G. Mundy, F.L.S.

Sierra Leone.—Agricultural Department:—

Director of Agriculture.	D. W. Scotland.
Assistant Director -	——
Assistant - - -	——
,,	——
Conservator of Forests -	——

Soudan.—

Khartoum	-	Director of Agriculture and Forests.	Major E. B. Wilkinson.
		Government Botanist	R. E. Massey.
		Superintendent of Palace Gardens.	*F. S. Sillitoe.
Jebelin	- -	Superintendent of Experimental Plantations.	*T. Cartwright.

Tanganyika Territory.—

Director of Agriculture	†A. H. Kirby, B.A.
Deputy Director of Agriculture.	H. Wolfe, M.Sc.
Senior District Agricultural Officer.	D. Prain.
District Agricultural Officer.	E. Brand.
,, ,,	†A. E. Haarer.
,, ,,	R. J. Lathbury, B.Sc.
,, ,,	A. Pitcairn.
,, ,,	O. E. Whitehead.
Plant Import Inspector	A. R. Hildebrand.
Head Gardener, Dar-es-Salaam.	*T. H. Marshall.
Director of Amani Institute.	A. Leechman, M.A., F.L.S.
Assistant Director of Amani Institute.	——
Curator, Amani Institute.	*F. M. Rogers.
Conservator of Forests -	D. K. S. Grant.

Uganda Protectorate.—

Kampala.—Agricultural Department:—

	Director of Agriculture	S. Simpson, B.Sc.
	Deputy Director of Agriculture.	L. Hewett.
	Mycologist.	W. Small, M.B.E., M.A., B.Sc.
	Botanist - - -	*T. D. Maitland.
	District Agricultural Officer.	*J. D. Snowden.
	,, ,,	†R. T. Wickham.
	Assistant Agricultural Officer.	*C. Hazel.
	,, ,,	*P. Chandler.
	,, ,,	*F. W. Hall.
	,, ,,	*G. T. Philpott.
	,, ,,	J. S. Harmsworth.
	,, ,,	*E. A. Ruck.

Entebbe.—Botanical, Forestry & Scientific Department:

	Chief Forestry Officer	*Robert Fyffe.

Zanzibar -	Director of Agriculture	F. C. McClellan, F.L.S.
	Assistant Director -	Robert Armstrong.
	Mycologist - - -	†Miss E. J. Welsford, M.B.E., F.L.S.
	Inspector of Plantations.	G. Tomson.

AUSTRALIA.

New South Wales.—Botanic Gardens:—

Sydney- -	Director and Government Botanist.	J. H. Maiden, I.S.O., F.R.S., F.L.S.
	Superintendent - -	E. N. Ward.
	Botanical Assistant -	E. Cheel.
	,, ,,	A. A. Hamilton.
	,, ,,	W. F. Blakeley.
	University Professor of Botany.	A. Anstruther Lawson, D.Sc., Ph.D., F.L.S.
	Technological Museum:— Curator - - -	R. T. Baker, F.L.S.
	Chief Commissioner of Forests.	R. D. Hay.

Queensland.—

Brisbane.—Botanic Gardens:—

	Government Botanist -	C. T. White, F.L.S.
	Curator - - -	E. W. Bick.
	Conservator of Forests -	E. H. F. Swain.

Lawnton.—Acclimatisation Society's Gardens:—

	Manager - - -	R. W. Peters.
Rockhampton	Superintendent - -	R. Simmons.

South Australia.—

Adelaide.—University Professor of Botany. T. G. B. Osborn, D.Sc.
Botanic Gardens:—
Director - - - J. F. Bailey.
Woods and Forests:—
Conservator - - Walter Gill, F.L.S.

Northern Territory.—

Port Darwin.—Botanic Gardens:—
Curator - - - *C. E. F. Allen.

Tasmania.—

Hobart - - Government Botanist Leonard Rodway, C.M.G.
Conservator of Forests L. G. Irby.
Botanic Gardens:—
Superintendent - - J. Wardman.

Tonga Islands.—

Director of Agriculture C. E. Wood.

Victoria.—

Melbourne.—Botanic Gardens:—
Curator - - - J. Cronin.
National Herbarium (South Yarra):—
Government Botanist - W. Laidlaw, B.Sc.
Assistant - - - J. R. Tovey.
,, J. W. Audas.
,, P. F. Morris.
University Professor of Botany. A. J. Ewart, D.Sc., Ph.D., F.L.S.
Chief Commissioner of Forests. Owen Jones, B.A.

Western Australia.—

Perth - - Botanist and Pathologist. D. A. Herbert, M.Sc.
Conservator of Forests - C. E. Lane Poole.

BERMUDA.

Agricultural Department:—
Director - - - E. A. McCallan.

CANADA.

Ottawa - - Director of Government Experimental Farms. J. H. Grisdale.
Dominion Horticulturist. W. T. Macoun.
Dominion Botanist - ——
Assistant - - - J. Adams.
,, - - - F. Fyles, B.A.

CEYLON.

Peradeniya.—Department of Agriculture:—

Director of Agriculture -	†F. A. Stockdale, M.A., F.L.S.
Botanist and Mycologist -	†T. Petch,, B.A., B.Sc.
Economic Botanist - -	†H. O. Iliffe, B.A.
Assistant Botanist and Mycologist.	†G. Bryce, M.A., B.Sc.
Assistant Mycologist - -	†M. Park, A.R.C.S.
Manager, Peradeniya Experiment Station.	G. Harbord.
Superintendent of Botanic Gardens.	†L. F. Macmillan.
Curator of Royal Botanic Gardens, Peradeniya.	*T. H. Parsons.
Curator, Hakgala Gardens -	*J. J. Nock.
Divisional Agricultural Officer.	†G. G. Auchinleck, B.Sc.
,, ,,	†N. Marshall.
,, ,,	†F. Burnett, M.C., B.A.
Plant Diseases Inspector (Mycological).	†E. A. Gadd.
Conservator of Forests - -	H. F. Tomalin.

CYPRUS.

Principal Forest Officer -	A. K. Bovill.
Director of Agriculture -	W. Bevan.

FALKLAND ISLANDS.

Government House Garden:—

Head Gardener - - - -	——
Forest Officer - - - -	†James Reid.

FIJI.

Superintendent of Agriculture and Curator, Suva Botanic Gardens.	——

HONG KONG.

Botanic and Forestry Department:—

Superintendent - - - -	*H. Green.
Assistant Superintendent - -	——

MALTA.

Superintendent of Agriculture -	J. Borg, M.D.
Superintendent of Public Gardens	——

MAURITIUS.

Reduit.—Department of Agriculture:—

Director - - - -	Hon. H. A. Tempany, D.Sc., F.I.C., F.C.S.
Assistant Director - -	†P. R Dupont.
,, - -	D. de Charmoy.
Agricultural Superintendent	*A. S. Clegg.
Agricultural Instructor -	J. W. Shand Harvey.

Port Louis.—Department of Forests:—

Director - - - - Paul Koenig.

NEW BRITAIN.

Rabaul.—Department of Agriculture:—

Director - - - - H. O. Newport.

Botanic Gardens:—

Superintendent - - ——

NEW ZEALAND.

Dunedin -	-	Superintendent -	- *D. Tannock.
Napier -	-	,, -	- W. Barton.
Auckland	-	Ranger - -	- William Goldie.
Christchurch	-	Head Gardener -	- J. Young.

SEYCHELLES.

Botanic Station:—

Curator - - - ——

MALAY PENINSULA.

Straits Settlements.—Botanic Gardens:—

Singapore	-	Director - - -	†I. H. Burkill, M.A., F.L.S.
		Assistant Director -	——
		Assistant Curator	- *G. A. Best.
Penang	-	Assistant Curator	- *F. Flippance.

Federated Malay States.—Forest Department:—

Conservator - - G. E. S. Cubitt.

Kuala Lumpur.—Agricultural Department:—

Director of Agriculture	L. Lewton-Brain, B.A., F.L.S.
Assistant to Director -	†F. de la M. Norris.
Mycologist - - -	†A. Sharples.
Assistant Mycologist -	†F. R. Mason.
Systematic Botanist -	†M. R. Henderson, B.Sc.
Economic Botanist -	†H. W. Jack, B.A., B.Sc.
Assistant Economic Botanist.	*W. N. Sands, F.L.S.
Physiologist - -	†W. N. C. Belgrave, B.A.
Agriculturist - -	†F. G. Spring, F.L.S.
,, - -	B. Bunting.
Assistant Agriculturist -	*J. N. Milsum.
,, ,,	†E. Farquharson.
Superintendent of Government Plantations	*J. Lambourne.

Federated Malay States—*continued.*

Kuala Lumpur—*continued.*

Chief Agricultural Inspector.		†F. W. South, B.A.
Assistant Agricultural Inspector.		*F. Birkinshaw.
,,	,,	A. E. Doscas.
,,	,,	†A. A. Campbell, B.Sc.
,,	,,	†J. Fairweather.
,,	,,	†G. E. Mann.
,,	,,	†J. L. Minto.
Agricultural Instructor		†D. H. Grist.
Superintendent of Coconut Plantations.		†T. C. Nock.

WEST INDIES.

Imperial Department of Agriculture :—

Barbados -	Commissioner - - -	Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.
	Scientific Assistant -	W. R. Dunlop, B.A.
	Economic Botanist -	T. G. Mason, B.A.
	Mycologist - - -	F. Ashby.

Antigua.—Government Chemist and Superintendent of Agriculture, Leeward Islands. — A. E. Collens, F.I.C., F.C.S. (Acting).

Botanic Station :—

Agricultural Superintendent.	*F. G. Harcourt.
Agricultural Assistant -	V. Pereira.
,, ,,	H. E. McDonald.
,, ,,	E. C. T. Michael.
,, ,,	E. Eldridge.

Dominica.—Botanic Station :—

Curator - - -	*Hon. Joseph Jones.
Assistant Curator and Assistant Chemist.	*Alfred Keys.

Grenada.—Botanic Garden :—

Agricultural Superintendent.	——
Agricultural Instructor -	W. O. Donovan
,, ,,	- E. L. Cherubim.

Montserrat.—Botanic Station :—

Curator - -	- *W. Robson.
Assistant Curator -	- A. W. Gallwey (Acting).

Imperial Department of Agriculture—*continued.*

St. Kitts-Nevis.—Botanic Station:—

Agricultural Superintendent.	F. R. Shepherd.
Assistant Superintendent	J. A. Robotham.
Agricultural Instructor, Nevis.	W. I. Howell.

St. Lucia.—Botanic Station:—

Agricultural Superintendent.	*A. J. Brooks, F.L.S., F.C.S.
Agricultural Assistant -	E. L. Beaubrun.

St. Vincent.—Botanic Station:—

Agricultural Superintendent.	*T. Jackson.
Assistant Agricultural Superintendent.	——

Virgin Islands.—Botanic Station:—

Curator - - -	C. A. Gomez.

Barbados.—Department of Agriculture:—

Superintendent - -	J. R. Bovell, I.S.O., F.C.S., F.G.S.
Assistant Superintendent	B. A. Bourne, B.Sc.

British Guiana.—Department of Science and Agriculture:—

Georgetown -	Director - - - -	Sir J. B. Harrison, C.M.G., M.A., F.I.C., F.C.S., F.G.S.
	Assistant Director -	†G. E. Bodkin, B.A.
	Mycologist - - -	——
	Horticultural Superintendent.	A. A. Abraham (Acting).
	Superintendent of Botanic Gardens and Agricultural Stations.	*Robert Ward.
	Superintendent of Sugar Experiment Stations.	J. Crabtree.
	Forestry Officer - - -	L. S. Hohenkerk.

British Honduras.—Botanic Station:—

Curator - - -	——

Jamaica - - Director - - - Hon. H. H. Cousins, M.A., F.C.S.

Assistant Director and Government Botanist —

Travelling Instructor - *William Cradwick.

,, ,, James Briscoe.

Public Gardens and Plantations:—

Assistant Superintendent. *E. Downes.

Farm Superintendent - P. W. Murray.

Tobago.—Botanic Station:—

Curator - - - R. J. Link.

Trinidad.—Department of Agriculture:—

Director - - - W. G. Freeman, B.Sc., A.R.C.S., F.L.S.

Assistant Director - W. Nowell, B.A., B.Sc.

Economic Botanist - *A. G. Bailey, B.A.

Mycologist - - - †F. Stell.

Assistant Botanist - *W. E. Broadway.

Curator, Royal Botanic Gardens. *R. O. Williams.

Conservator of Forests - C. S. Rogers.

INDIA.

Botanical Survey of India:—

Director - - - - - Lt.-Col. A. T. Gage, I.M.S., M.A., M.B., B.Sc., F.L.S.

Economic Botanist - - - —

Assistant for Phanerogamic Botany P. M. Debburman, B.Sc.

,, ,, ,, N. Naryanswami, M.A.

Departments of Agriculture, Botanical Officers attached to:—

Imperial Agricultural Research Institute, Pusa, Bengal:—

Imperial Mycologist - - †W. McRae, M.A., B.Sc., F.L.S.

Second Imperial Mycologist F. J. F. Shaw, D.Sc., F.L.S.

Supernumerary Mycologist - J. F. Dastur, M.Sc.

Imperial Economic Botanist —

Bengal Agricultural Department, Dacca:—

Economic Botanist - - G. P. Hector, M.A., B.Sc.

Bihar and Orissa Agricultural Department, Sabour:—

Economic Botanist - - —

Bombay Agricultural Department, Poona:—

Economic Botanist - - †W. Burns, D.Sc.

Departments of Agriculture, Botanical Officers attached to—*continued.*

Central Provinces Agricultural Department, Nagpur :—

Economic Botanist	-	——

Madras Agricultural Department, Coimbatore :—

Government Sugarcane Expert.		——
Government Economic Botanist.		F. R. Parnell.
,, ,,	(for Cotton)	G. R. Hilson, B.Sc.
Government Lecturing Botanist.		K. Rangachari, M.A.
Government Mycologist		——

Punjab Agricultural Department, Lyallpur :—

Economic Botanist	-	†D. Milne, B.Sc.

United Provinces Agricultural Department, Cawnpur :—

Director of Agriculture (Lucknow).		†H. M. Leake, M.A., F.L.S.
Economic Botanist	-	W. Youngman, B.Sc.
Plant Pathologist	-	P. K. Dey.

North-West Frontier Province :—

Agricultural Officer	-	*W. R. Brown.

BENGAL.

Calcutta.—Royal Botanic Garden, Sibpur :—

Superintendent	- -	Lt.-Col. A. T. Gage, I.M.S., M.A., M.B., B.Sc., F.L.S.
Curator of Herbarium	-	†C. C. Calder, B.Sc., F.L.S.
Curator of Garden	-	*G. T. Lane.
1st Overseer	- -	N. Mitra.
2nd Overseer	- -	M. Jones.
Probationer	- -	——

Gardens in Calcutta :—

Assistant Curator	-	*P. V. Osborne.
Overseer - -	-	S. N. Bose.

Agri-Horticultural Society of India :—

Secretary - -	-	S. P. Lancaster.

Darjeeling.—Lloyd Botanic Garden :—

Superintendent	- -	Lt.-Col. A. T. Gage, I.M.S., M.A., M.B., B.Sc., F.L.S.
Curator - -	-	*G. H. Cave.
Acting Curator	- -	*W. V. North.

Cinchona Department.—

Superintendent of Cinchona Cultivation.		Lt.-Col. A. T. Gage, I.M.S., M.A., M.B., B.Sc., F.L.S.

Cinchona Department—*continued.*

Mungpoo Plantation:—

Manager - -	- *P. T. Russell.
1st Overseer -	- P. Cresswell.
2nd Overseer -	- James Hulbert.

Munsong Plantation:—

Manager - -	- *H. F. Green.
Assistant Manager	- *H. Thomas.
Overseer - -	- G. Holl.

BOMBAY.

Bombay City.—Municipal Garden:—

Superintendent -	- J. M. Doctor.

Ghorpuri.—Botanic Garden:—

Superintendent -	- P. G. Kanetkar.

Poona.—Government Gardens:—

Superintendent -	- *E. Little.

BURMA.

Maymyo.—Government Botanic Garden:—

Curator - -	- †R. E. Cooper.

CENTRAL PROVINCES.

Nagpur.—Public Gardens:—

Superintendent -	- *J. E. Leslie.

MADRAS.

Madras City.—Agri-Horticultural Society:—

Superintendent -	- H. E. Houghton, F.L.S.

Ootacamund.—Government Gardens and Parks:—

Curator - -	- *F. H. Butcher.

Cinchona Department.—

Deputy Director of Agriculture (Cinchona)	A. Wilson, B.Sc.
Superintendent, Dodabetta Plantation.	H. V. Ryan.
Superintendent, Nediyattam and Hooker Plantations.	E. Collins.

PUNJAB.

Delhi.—Government Horticultural Department:—

Officer-in-Charge.	- *A. E. P. Griessen.

Historic and other Gardens:—

Superintendent -	- *R. H. Locke.

Lahore.—Government Gardens :—

Superintendent - - *A. Hardie.

Lawrence Gardens :—

Superintendent - - *W. R. Mustoe.

Simla.—Vice-regal Estate Gardens :—

Superintendent - - *Ernest Long.

UNITED PROVINCES OF AGRA AND OUDH.

Agra.—Taj and other Gardens :—

Superintendent - - *R. Badgery.

Allahabad.—Government Gardens :—

Superintendent - - *W. Head.

Cawnpur.—Memorial and other Gardens :—

Superintendent - - — Johnson.

Kumaon.—Government Gardens :—

Superintendent - - *Norman Gill, F.L.S.

Lucknow.—Horticultural Gardens :—

Superintendent - - ——

Probationer - - ——

Saharanpur.—Government Botanic Gardens :—

Superintendent - - ——

Dehra Dun.—Imperial Forest Research Institute :—

Imperial Forest Botanist R. S. Hole, C.I.E., F.L.S.

ASSAM.

Shillong.—Government Gardens :—

Curator - - - *L. F. Ruse.

NATIVE STATES.

Indore :—

Economic Botanist - A. Howard, C.I.E., M.A., F.L.S.

Mysore (Bangalore) :—

Economic Botanist - ——

Baroda :—

Superintendent - - T. R. Kothawala.

Travancore (Trivandrum) :—

Director - - - Major F. W. Dawson.

Udaipur :—

Superintendent - - T. H. Storey.

Gwalior :—

Director, State Gardens *B. F. Cavanagh.